TELEPHONE ENGINEER

MANAGEMENT • ENGINEERING • MAINTENANCE

AUGUST 1936

Cover Illustration
"IT PAYS TO ADVERTISE"
Truck of Electra (Tex.) Telephone Co.

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TELEPHONE TRANSMISSION THEORY and PRACTICE
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THE CHARDON TELEPHONE COMPANY

TELEPHONE BUILDING

CHARDON, OHIO

DR. O. POMEROY, President
M. M. GILMORE, Manager
C. L. SMITH, Treasurer
W. C. PARSONS, Secretary

April 13, 1936

Mr. C. E. Brown, Sales Representative
Kellogg Switchboard and Supply Company,
Chicago, Illinois.

Dear Mr. Brown:

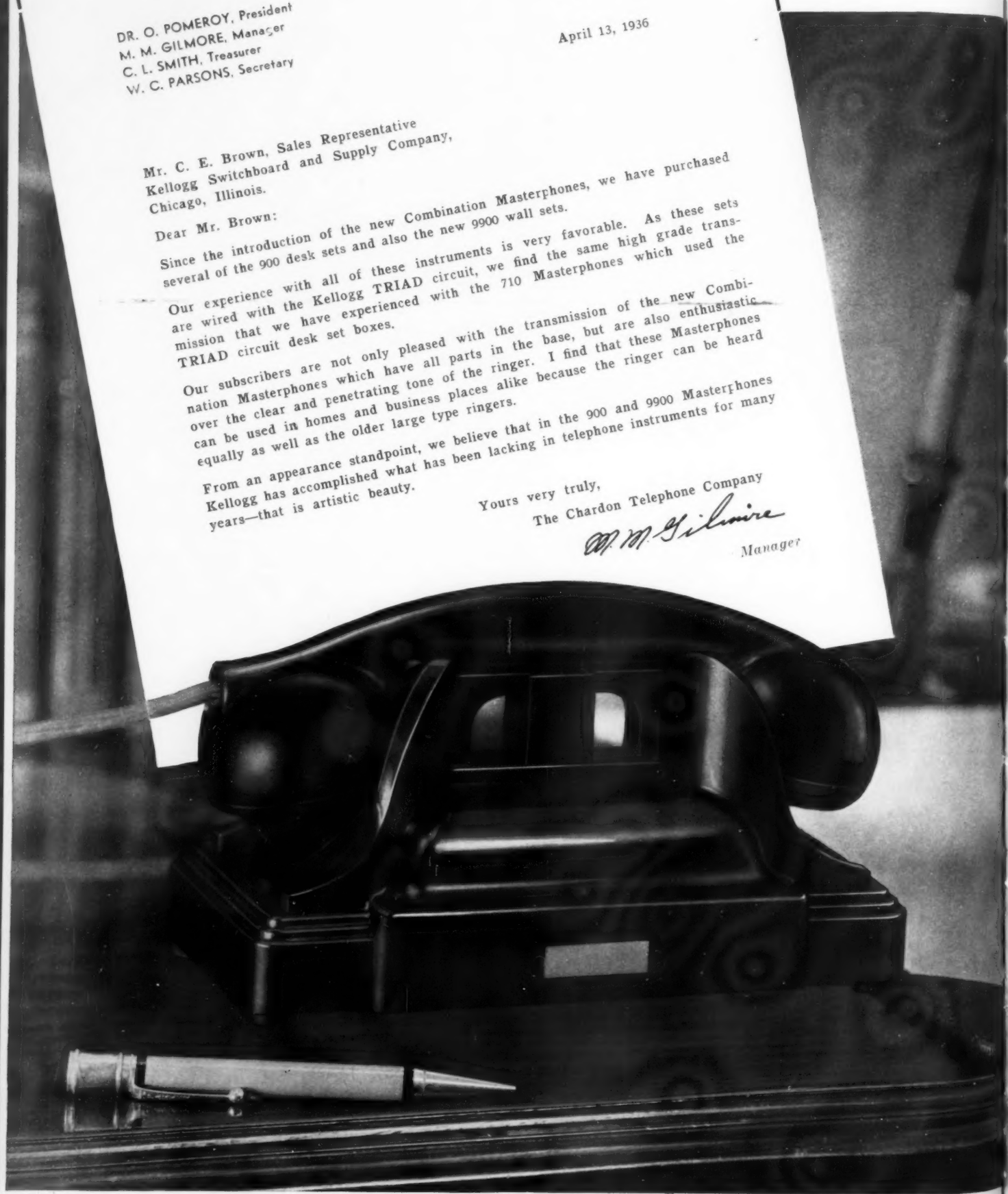
Since the introduction of the new Combination Masterphones, we have purchased several of the 900 desk sets and also the new 9900 wall sets.

Our experience with all of these instruments is very favorable. As these sets are wired with the Kellogg TRIAD circuit, we find the same high grade transmission that we have experienced with the 710 Masterphones which used the TRIAD circuit desk set boxes.

Our subscribers are not only pleased with the transmission of the new Combination Masterphones which have all parts in the base, but are also enthusiastic over the clear and penetrating tone of the ringer. I find that these Masterphones can be used in homes and business places alike because the ringer can be heard equally as well as the older large type ringers.

From an appearance standpoint, we believe that in the 900 and 9900 Masterphones Kellogg has accomplished what has been lacking in telephone instruments for many years—that is artistic beauty.

Yours very truly,
The Chardon Telephone Company
W. M. Gilmore
Manager



900 TYPE MANUAL COMBINATION Kellogg Masterphone

TELEPHONE ENGINEER

A MONTHLY SERVING ENTIRE TELEPHONE INDUSTRY

30-DAY LIFE FOR READERS AND ADVERTISERS

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THE POLICY OF THE TELEPHONE INDUSTRY

"The most telephone service and the best at the least cost to the public. Telephone service free from imperfections, errors, delays and always at a cost as low as is consistent with financial safety."

• • •

THE TELEPHONE INDUSTRY in 1935—

- **Employed 335,000 persons.**
- **Paid $427,000,000 in salaries and wages.**
- **Paid $104,000,000 in taxes.**
- **Paid $193,000,000 in dividends to 800,000 stockholders.**

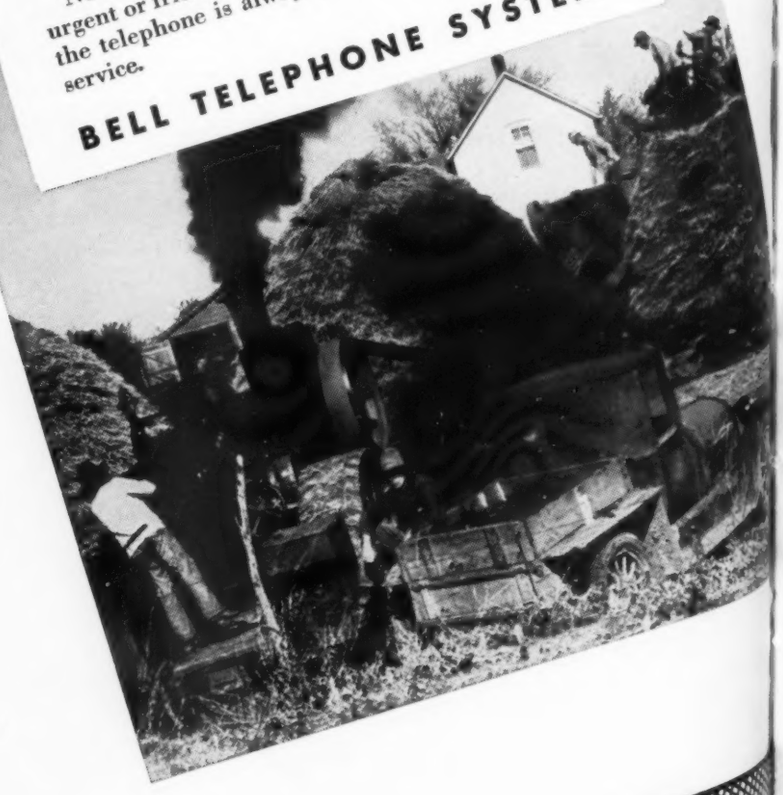
"THE TELEPHONE PAYS ITS OWN WAY ON OUR FARM"

"WE USUALLY call several places to find out about prices and then sell at the highest quotation. On one sale of 3000 bushels of wheat, we made $90 extra that way."

A farmer near Central City, Nebraska, cites this instance as an example of how the telephone makes itself useful on his farm. He could tell of many other ways, as could the thousands of farmers who have a telephone. Of important telephone conversations with county agent or co-operative association, with neighbors during the busy season, or with the implement dealer when there's a breakdown. Of daily telephone contacts with friends. Of hurried calls in time of illness or accident.

No matter what the occasion, whether urgent or friendly chat to pass the time, the telephone is always ready to be of service.

BELL TELEPHONE SYSTEM



AN ADVERTISEMENT OF THE BELL TELEPHONE SYSTEM

TELEPHONE ENGINEER
MANAGEMENT • ENGINEERING • MAINTENANCE

AUGUST, 1936

"Tapping In" On Washington

By ROLAND C. DAVIES
Editor
Telecommunications Reports

● One of the most important policies which is expected to be evolved by the Federal Communications Commission during the next year is a definite classifying of the federal regulatory jurisdiction over Independent telephone companies. During the month of July, the Commission took a step of considerable progress towards the clarification of these jurisdictional boundaries.

The issue of whether the furnishing of circuits to broadcasting stations for program transmission constituted an act of interstate commerce for telephone companies had arisen in the case of two Independent telephone companies—the Capital City Telephone Co. of Jefferson City, Mo., and the Rochester (N. Y.) Telephone Corp. In both instances, the Commission's chief examiner recommended that such service did not make the carriers interstate companies when their wire system was purely intrastate and only linked for interstate communication through "physical connection".

While the recommendations of the chief examiner still await formal approval by the FCC Telephone Division, it is expected that this finding during the early fall will receive the sanction of the Commission. Already the recommendation in the case of the Capital City Company of Missouri has received the approval of the division and is now awaiting just the formal step of ratification. The Rochester case will not be settled until the decision is taken by the Commission on the issue of alleged Bell System control of this large Independent telephone company which the chief examiner found existed.

● The ruling of the FCC on the question of the interstate character of circuits furnished by telephone companies to broadcasting stations for program transmission will free, it is expected, more than 30 Independent telephone companies from being subject to the federal regulation of the Communications Commission. Among these are a number of the larger Independents, such as the Lincoln, (Nebr.) Telephone and Telegraph Co., the Durham, (N. C.) Telephone Co. and the York, (Pa.) Telephone Co., all of which have been furnishing program transmission circuits to one or more broadcasting stations. This interstate commerce theory arose early in the history of the FCC when a commission lawyer suggested the principle because courts, including the U. S. Supreme Court, had invariably held broadcasting to be interstate commerce.

In the meantime Chief Examiner Arnold recommended August 4 that North-West Telephone Co., Tomah, Wis., be deemed under control of Wisconsin Telephone Co. and that the telephone division assume jurisdiction over the company as an interstate carrier.

Arnold's report found that the North-West company keeps its accounts, books and records in its office at Tomah; that it consults the Bell company and Independent concerns about its engineering problems, but does not always follow advice given by the Bell company; that of 1,373 shares of North-West's outstanding common stock, the Bell company has purchased 344 shares outright and has acquired an additional 853 shares by payment of the principal amount of a note in default made by John S. Allen, president of North-West, or a total of 1,197 shares owned by the Bell company; that four members of the Allen family on the North-West board of directors are holding office contrary to provisions of the company's by-laws and with the tacit, if not expressed, approval of the Bell company.

Independent telephone companies, it is believed, are desirous of having the determination of the FCC's jurisdiction under its Section 2(b) 2 of the Communications Act — the "physical connection" provision — settled as soon as possible so that no further legislation on jurisdiction demarking interstate and intrastate carriers will be sought from Congress. It will be recalled that, when the Communications Act was being considered by the 1934 Congress, some proponents of federal regulation suggested that the size of the Independent telephone companies be the determining factor of whether they should

come under the jurisdiction of the FCC. This test was finally based in the provisions of the Communications Act upon "Bell System control" and "physical connection" which was deemed satisfactory and it is felt that the Independent industry wants no change in the law on the jurisdictional provisions.

• • •

May Mark Time . . .

Until the November presidential election, the FCC is expected to mark time as far as rendering major or controversial decisions are concerned. Numerous hearings are on the program for the Fall, including the complaint of the Oklahoma - Arkansas Telephone Co. against the Southwestern Bell Telephone Co. to be held in Fort Smith, Ark.; the oral argument before the telephone division of the Rochester Telephone Corp. and two other Independent companies and the resumption of the telephone investigation. Hearings also may occur on the part of the FCC telegraph division on the questions of leased wire and teletypewriter exchance services and their role in the nation's telegraphic communications.

● During the two summer months of July and August the telephone investigation staff has been materially reduced in size because the $750,000 appropriation had been exhausted and now the $400,000 fund, allotted in the closing days of the last Congress, is being used. The fact that so far little accomplishment of definite character was produced at the investigation hearings of last Spring has given rise to rather authoritative speculation in Washington about a Congressional probe of the FCC as a strong likelihood, no matter the result of the presidential election. In the last Congress several moves for an inquiry into the FCC developed without materializing, because of the desire of administration leaders to block any probe of New Deal agencies. The major objective of these investigation attempts at the last Congress was directed towards the broadcasting supervision by the FCC but the next Congress probably will center attention upon the telephone investigation as well as on broadcasting, if such an inquiry by the legislative branch should materialize.

While economy is slated to be in the wind next year in the federal government, the FCC may try to be an exception. There is understood to be a desire by the Commission authorities to secure a considerably increased appropriation for the next fiscal year, commencing July 1, 1937, to enlarge the work of telephone regulation. For the present fiscal year which ends June 30, 1937, the FCC has an appropriation of $1,474,000 but also has had the $1,150,000 allotted for the special telephone investigation. What the FCC authorities wish is to secure an additional regular appropriation for telephone work because the investigation fund will be exhausted by next Feb. 1. The FCC is now preparing its 1937-38 fiscal year estimates which will be submitted to the budget bureau by Sept. 15. It would be a good bet, however, that the Congress will be enough economy-minded so that the FCC or any other federal government department or commission seeking increased appropriations will have tough sledding to get them approved.

THE FRONT COVER

The illustration on the front cover shows what can be done in the way of telephone advertising. The photograph presents a rear view of the Electra (Tex.) Telephone Company's "trouble truck".

The location for the message is ideal and D. M. Robb, manager of the Electra company, has done an excellent job in saying a lot in a few words.—Courtesy, The Texas Telephone Association and Electra Telephone Co.

• • •

Toll Rates Cut . . .

The American Telephone and Telegraph Co. gave the FCC a pleasant surprise on July 31 with the filing of a tariff containing sweeping reductions in long distance rates for calls beyond 234 miles. The new rate reduction, which will become effective Sept. 1, is estimated to lower toll charges to the American telephone-using public by $7,350,000, including A. T. & T. and Bell System companies' toll service.

The reductions will comprise the slashing of toll rates to a considerable degree, illustrated by a 50-cent slice off the present New York - Chicago charge and $1.50 off the New York-San Francisco rate. In addition the new tariff reduces the charges for person-to-person calls on all conversations of more than six minutes' duration.

● The September 1 reduction will mark the seventh major lowering of toll rates by the A. T. & T. since Oct. 1, 1926. All of the rate cuts have been made voluntarily by the A. T. & T. In the past two years the A. T. & T. has inaugurated the night rate for toll service, eliminating the old evening rate, and has established reduced rates for the week-ends. These latter two reductions, estimated at $3,000,000, and the recent lowering to be effective Sept. 1, will make the total drop in toll charges at approximately $10,000,000 since the FCC was established in July, 1934.

• • •

Depreciation Regulation . . .

The annual assembly of state utilities commissioners, which will be held at Atlantic City, November 10-13, seems to be tinged with some thought that the FCC should not encroach upon regulatory activities of the state commissions over the telephone industry. This view seemed to have been indicated by the recently announced topics of the convention on telephone regulation. These included the subjects of "what action, if any, should the FCC take with respect to depreciation" and "what classes of telephone companies are subject to the jurisdiction of the FCC under Section 2(b) (2) of the Communications Act". The telephone investigation was not included as a topic for discussion on the formal program.

• • •

Pot-Pourri of Comment . . .

A recent FCC statistical compilation showed that for 1934, 421 officials in the telephone industry received salaries of $10,000 or more. There were 43 such officials in the telegraph industry. The executives comprised 0.165 per cent of the total employees of the telephone industry with their salaries making up 1.901 per cent of the total payroll and 0.777 per cent of the total operating revenues. In the telephone industry the average salary of the various positions was: board chairman, $45,833; president, $33,000; vice-president, $22,917; secretary or treasurer, $14,500; comptroller, $15,492; general manager, $16,958; general counsel, $21,771; chief engineer, $12,559.

Labor Dispute

● The battle between John L. Lewis, United Mine Workers head with his Committee on Industrial Organization against the American Federation of Labor holds interest for the telephone industry because of Lewis's threat to unionize all industries which have the so-called "company unions". In the telephone and telegraph industries, most of which is non-unionized, however, recent Labor Department statistics show a better payroll record than for other industries. The telephone and telegraph industries had an average weekly wage of $28.80 which was better by $8 and $10 than the anthracite and bituminous coal industries which have been thoroughly unionized by Mr. Lewis's group.

Telephone Transmission
Theory and Practice

By ROBERT A. CLARK, JR.

CHAPTER VII

Miscellaneous problems in telephone transmission are discussed in this chapter, including the theory of the telephone transformer or repeating coil. Formulas and a table for use in designing attenuation networks are shown.

● Before we take up the study of telephone lines and equipment there are a few problems in transmission theory which heretofore have not been considered but which are quite important and deserve some discussion. One of these is the matching of impedance characteristics and the effect on telephone transmission of improperly matched equipment. In the preceding chapters we have referred to the impedance of a telephone line of 600 ohms or a receiver of 200 ohms. We ordinarily speak of the impedance of a line or equipment as having a given value at the voice frequencies. Actually the impedance over the voice frequency band varies considerably. There was a short discussion of this subject in Chapter IV on which I would like to elaborate. You will recall (Chapter III) that the impedance is equal to the square root of the sum of the resistance squared plus the reactance squared, or expressed algebraicly

$$Z = \sqrt{R^2 + X^2} \qquad (17)$$

Where **Z** is the impedance in ohms, **R** is the resistance and **X** is the reactance in ohms either inductance or capacity. The components, **R** and **X**, are a function of many factors depending on the type of equipment. For example, let us study the characteristics of a typical low-resistance type telephone receiver. Fig. 35 shows the resistance and reactance components as a function of frequency. You will note that both the inductance and the resistance change appreciably as the frequency is varied. Also the load on the receiver, which is a function of the distance between the receiver diaphragm and the ear, has an appreciable effect on the two components. Furthermore, they also change appreciably with the energy level. For these reasons a single frequency measurement of resistance and inductance for use in equation 17 does not present the entire picture. Furthermore, as stated previously in Chapter IV, there is no relation between the d-c resistance and the a-c resistance which is a function of the losses in the apparatus itself and the load imposed upon it.

● In most telephone equipment the variation in impedance characteristics over the voice band is generally of little importance. This is not true in all cases however, such as in telephone repeater operation where such variations must be taken in consideration in order to properly design the line balancing networks. You will recall in Chapter IV we assumed for the sake of simplicity, that the reactance was negligible compared to the resistance in our calculation of power losses. Experience has shown us that in many cases this is a logical assumption. Often it is better to assume a value for the equivalent resistance equal to the impedance as determined by formula (17). For example, we may assume that the telephone receiver having the characteristics shown in Fig. 35 has at 1,000 cycles an impedance of 300 ohms all resistance. Actually over the voice band the resistance will vary from about 60 to 200 ohms and the impedance from around 100 ohms to over 500 ohms. However, we know by experience that if in our design of equipment for use with such a receiver we assume an a-c resistance of 300 ohms a satisfactory solution will be had.

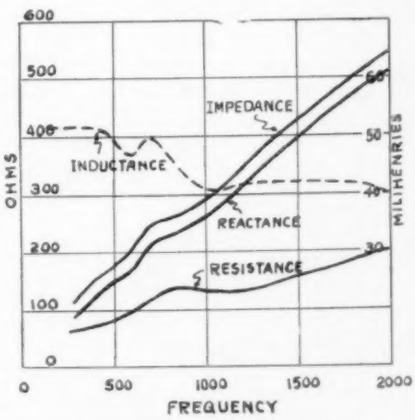


Fig. 35—Impendance characteristics of a typical telephone receiver.

The question will no doubt arise in your mind as to just why the necessity for so called impedance matching of which you hear so frequently. The first reason is the matter of power transfer. This we have discussed in Chapter IV in some detail. You will observe in Fig. 26 (Chapter IV) that there can be an appreciable mismatch without seriously effecting the efficiency of power transfer. For example, if the output impedance of the source is 600 ohms and the impedance of the load is

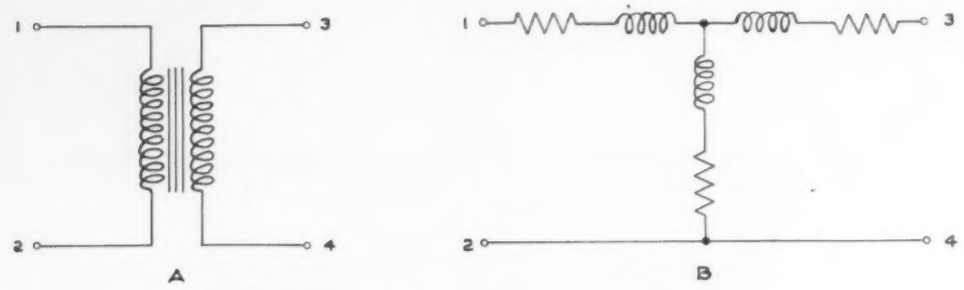


Fig. 36—Circuit illustrating principles of a telephone transformer or repeating coil.

1200 ohms we still obtain about 90 per cent of the power in the load that we would if the two impedances were equal. In transmission loss this is equivalent to about 1 db. We term the loss which is incurred under such circumstances a **transition loss.** Often times you will hear it spoken of as a **reflection loss.** Mathematically the two terms are not exactly the same. However, practically there is little difference. The formula for transition loss in db is

$$\text{db}=10 \log\left(\frac{4\mathbf{R}_1\,\mathbf{R}_2}{(\mathbf{R}_1+\mathbf{R}_2)^2-(\mathbf{X}_1+\mathbf{X}_2)^2}\right) \quad (26)$$

Where $\mathbf{R}_1$ and $\mathbf{X}_1$ represent the resistance and the reactance respectively of the source and $\mathbf{R}_2$ and $\mathbf{X}_2$ represent the resistance and the reactance of the load. If, as we have assumed in the past, the reactance component is negligible, the formula simplifies to

$$\text{db}=10 \log\left(\frac{4\mathbf{R}_1\,\mathbf{R}_2}{(\mathbf{R}_1+\mathbf{R}_2)^2}\right) \quad (27)$$

In order that you may gain an understanding of the relative losses that may result from mismatching, Table 9 showing the decibel loss for various ratios of impedance has been prepared. Aside from the effect on telephone repeater operation the mismatching of equipment commonly used in telephone practice has little effect other than increasing the transmission equivalent of the circuit.

TABLE 9

RELATION OF IMPEDANCE MISMATCH TO TRANSITION LOSS IN DB

Impedance Ratio	DB
0.1	4.8
0.2	2.5
0.4	0.9
0.6	0.3
0.8	0.05
1.0	0.0
1.5	0.2
2.0	0.5
4.0	1.9
7.0	3.6
10.0	4.8

● In a few circumstances, improperly matched impedances may result in appreciable distortion. This is seldom of importance in ordinary voice telephone transmission but may be quite serious in the case of high quality circuits such as those used in public address systems and radio broadcasting. In order to see how this occurs it will be necessary for us to study the theory of the repeating coil or transformer. You undoubtedly all know the function of a repeating coil and its use to isolate circuits, provide combined telegraph and telephone facilities, etc. You are also undoubtedly familiar with the typical power transformer whereby voltages may be stepped up or down depending on the ratio of turns on the primary and secondary windings. I will therefore not take time to discuss the elementary principles but will take up briefly certain fundamental relations that exist. In Fig. 36, we have the circuit of a telephone transformer (A) and its equivalent network represented by three branches (B). For any given frequency we can find a combination of resistance and inductance for the equivalent network such that the effect, if inserted in a circuit in place of the transformer, would be the same.

You know that in a power transformer the ratio of the number of turns on the primary and secondary determine the ratio of voltages at the terminals. For example, in Fig. 36 (A) if the number of turns on winding 3-4 were twice that of winding 1-2 and 1 volt a-c was applied to winding 1-2 we would measure two volts across winding 3-4. Or if winding 3-4 had only one-half as many turns as winding 1-2 we would measure 0.5 volts across winding 3-4. This leads to the formula expressing the relation between the turn ratio on the primary and secondary and the voltage ratio which is

$$\frac{\mathbf{V}_{12}}{\mathbf{V}_{34}}=\frac{\mathbf{N}_{12}}{\mathbf{N}_{34}} \quad (28)$$

Where $\mathbf{N}_{12}$ is the number of turns on winding 1-2 and $\mathbf{N}_{34}$ is the number of turns on winding 3-4, $\mathbf{V}_{12}$ is the voltage applied to winding 1-2 and $\mathbf{V}_{34}$ is the voltage measuring across winding 3-4. These are the voltages which would be measured when no appreciable load is connected to the transformer.

● If we were to connect a 600-ohm resistance to winding 3-4 and measure the impedance looking into winding 1-2 we would find that the measured resistance reflected through the transformer was also a function of the turn ratio. If for example, the winding 3-4 had twice as many turns as 1-2 we would find that the a-c resistance measured across terminals 1-2 with terminals 3-4 connected to 600 ohms was 150 ohms. It can be shown mathematically that the resistance as measured above varies as the square of the turn ratio on the transformer. Expressed algebraically this is.

$$\frac{\mathbf{Z}_{12}}{\mathbf{Z}_{34}}=\left(\frac{\mathbf{N}_{12}}{\mathbf{N}_{34}}\right)^2 \quad (29)$$

Where $\mathbf{Z}_{34}$ is the value of the impedance connected to terminals 3-4, $\mathbf{Z}_{12}$ is the impedance as measured across terminals 1-2 by means of an a-c bridge for example, $\mathbf{N}_{34}$ is the number of turns on winding 3-4 and $\mathbf{N}_{12}$ is the number of turns on winding 1-2. It will be obvious to you that by means of a proper ratio transformer, lines or equipment of different characteristic impedance may be connected together with no resultant transition loss.

● Referring to Fig. 36 you will note that the equivalent circuit of the transformer contains a shunt impedance which obviously must be sufficiently large so as to cause no appreciable loss due to it shunting effect. Similarly the series arms must be sufficiently small so that they will cause no appreciable loss due to the voltage drop through them. Experience indicates that the shunt arm should have an impedance of at least 15 or 20 times the impedance of the circuit to which the transformer is connected. The series arms should in general have an impedance not more than about 5 per cent of the impedance of the circuit to which the transformer is connected. Obviously these conditions must exist over the frequency band which is to be transmitted. We must design the transformer so that at low frequencies the equivalent shunt impedance will be sufficiently high and

at the high frequencies the series impedance sufficiently low. Modern transformer design has enabled us to obtain transformers which meet these requirements over a frequency range as broad as from 15 to 15,000 cycles, the frequency response being uniform over such a band within about 2 db and having a loss in the middle of the frequency range not exceeding about ½ db.

Returning to the effect of improper matching on distortion, most circuits involve transformer coupling or its equivalent, between the elements. Assume for example, we have an amplifier such as is used in public address operation having an output transformer designed to match a 5,000-ohm load. If we were to connect to this amplifier a loud speaker having a nominal impedance of 300 ohms and impedance characteristics similar to that shown in

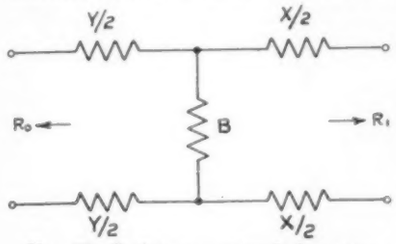


Fig. 37—Resistance network for introducing loss in a circuit and matching circuits of different impedance.

Fig. 35 we would have a mismatch of 10 to 1 at 1,000 cycles or a transition loss of about 4.8 db. At 300 cycles the mismatch would be in the order of 35 to 1 and the transition loss about 9 db. The low frequency response would therefore be seriously impaired and the distortion resulting therefrom very obvious. We may conclude, therefore, that in order to obtain good quality, the impedance match over the frequency range must be reasonably uniform.

On the other hand if we were to connect a 3,000-ohm receiver (nominal impedance) to an amplifier having an output impedance of 300 ohms we would find that the distortion was not nearly so apparent. An explanation for this may be had by referring to Fig. 26. We see that when the load resistance is several times as great as the source output impedance the variation in received power is not so great for relatively large changes in load resistance. There is some variation in transition loss however which tends to impair the high frequency response.

● The above examples therefore serve to illustrate that for good quality of voice transmission we must make certain that the equipment is fairly well matched. I would say that in general, satisfactory operation will be had if impedances are matched to within a two to one ratio. This is not always practical however, as for example when open wire circuits are connected to non-loaded sections of cable. The mismatch in such instances may be as great as four to one especially at carrier frequencies. In such cases, it is often practical to install matching transformers having the proper turn ratio to permit a reasonable match over the frequency band being transmitted.

If it were not for the effect of the inductance and capacity in circuits the transition loss would be uniform for all frequencies. This point should be kept in mind as there are many cases where mismatching impedance causes no distortion, the only effect being that of the transition loss. We have spoken of matching circuits of different impedance by means of a transformer having the proper turn ratio. It is also possible to match circuits by means of a resistance network such as shown in Fig. 37. The following three formulas may be used to compute the values of resistance for any given set of conditions:

$$\mathbf{Y}=\mathbf{R}_0-(\mathbf{R}_1+\mathbf{X})\mathbf{K} \qquad (30)$$

$$\mathbf{B}=\frac{\mathbf{K}\,(\mathbf{R}_1+\mathbf{X})}{1-\mathbf{K}} \qquad (31)$$

$$\mathbf{X}=\mathbf{R}_1-\frac{1}{\frac{1}{\mathbf{B}}+\frac{1}{\mathbf{Y}+\mathbf{R}_0}} \qquad (32)$$

Where $\mathbf{R}_0$ is the source impedance and $\mathbf{R}_1$ the load impedance, **K** is the ratio of load current to source current (this will always be less than 1) **X, Y,** and **B** are the resistance value of the network as shown in Fig. 37.

● If the load resistance ($\mathbf{R}_1$) is equal to the source impedance ($\mathbf{R}_0$) the network of Fig. 37 may be used to introduce a transmission loss of any desired amount. Such sections of loss are known as pads and are used in many ways. The two following formulas may be used to determine the resistance values of the network for any given impedance and loss requirement:

$$\mathbf{X}=\mathbf{Y}=\left(\frac{1-\mathbf{K}}{1+\mathbf{K}}\right)\mathbf{R}_0 \qquad (33)$$

$$\mathbf{B}=\frac{\mathbf{K}\,(\mathbf{X}+\mathbf{R}_0)}{1-\mathbf{K}} \qquad (34)$$

Where **K** is the ratio of received current to source current, $\mathbf{R}_0$ the impedance of the source and the load. The current ratio (**K**) can be determined by means of Table 7 in Chapter VI, it being the same as the voltage ratio shown in the table. For example, the current ratio for a transmission loss of I db is (from Table 7) 0.891. For most telephone applications the circuit impedance is 600 ohms; the values of the resistors **X, Y** and **B** for losses up to 30 db are shown in Table 10. This table is convenient for designing pads commonly used in telephone work.

TABLE 10

RESISTANCE VALUES FOR ATTENUATION PADS, 600 OHM IMPEDANCE

Loss in DB	X & Y	B
1	34.5	5190
2	68.8	2582
3	103.0	1704
4	136.0	1259
5	168.0	987
6	199.0	803
7	230.0	678
8	258.0	568
9	286.0	505
10	312.0	422
11	336.0	367
12	359.0	322
13	380.0	283
14	400.0	249
15	419.0	220
16	436.0	195
17	451.0	173
18	466.0	153
19	479.0	136
20	491.0	121
21	502.0	108
22	512.0	96.0
23	521.0	85.3
24	529.0	76.0
25	536.0	67.7
26	543.0	60.3
27	549.0	53.7
28	554.0	47.8
29	559.0	42.7
30	563.0	37.9

You will note that in Fig. 37, all of the resistance is on one side of the cir-

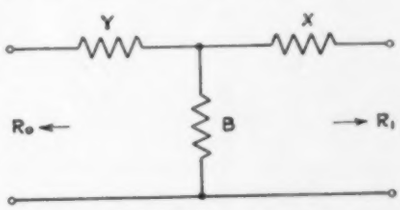


Fig. 38—Balanced pad used in telephone practice.

cuit. In telephone operation where all equipment and lines must be balanced to ground in order to prevent noise and cross-talk such a network would obviously be unsuitable. However, it may be converted into a balanced pad merely by dividing the resistance **X** and **Y,** in two and inserting each half in one side of the circuit as shown in Fig. 38. This is the type of pad commonly used in telephone practice.

(TO BE CONTINUED)

By C. K. BROWN

Switchboard Maintenance

In this installment Mr. Brown discusses the relationship of electric current, electromotive force and resistance and presents formulas to explain these important factors in P. B. X. maintenance.

PART II

● In the operation of P. B. X. equipment there are three important factors to be taken into account. The first one is the electric current, which is due to the second one, electromotive force, acting against the third one, resistance. They are indicated in algebraical equation by the respective letters **"E"** for E. M. F., **"I"** for current intensity, and **"R"** to designate resistance or ohms.

The current intensity or value in amperes is directly proportional to the E. M. F. and indirectly proportional to the resistance, that is, the electric current produced in a closed circuit by the given E. M. F. is modified by the resistance of the entire circuit. This is a statement of Ohm's Law.

The E. M. F. across any part of a circuit is commonly expressed as the "voltage drop". The idea of voltage drop involves a relative condition of two points, the term being used to indicate the difference between the potential (electrical level) of a conductor and the potential of the earth, which is assumed to be zero. Any substance which will permit the so-called flow of an electric current is a conductor. The potential at any point in a conductor, therefore, represents the excess or the insufficiency of its potential above or below that of the earth. This is shown graphically in Fig. 1. **"AB"** represents a wire of uniform resistance 500 feet long, and **"AC"** represents the potential at the point **"A"**. The slanting line **"CB"** will then represent the voltage drop along the line **"AB"**. At **"E"**, the voltage has fallen one-half as may be verified by measuring the height of the line **"E"** as compared with **"AC"**.

● The point **"E"** is, therefore, the center of the wire, or 250 feet from the battery. At **"D"** the voltage has dropped one quarter, therefore, **"AD"** is 125 feet in length. Similarly the point **"F"** is three quarters of 500 feet or 375 feet from the battery, and the point **"B"** where the voltage has fallen to zero, is the free end of the wire.

If the wire is not of uniform resistance, the voltage at any point along the wire is proportional to the resistance overcome.

Example: Find the resistance overcome at a certain point in a P. B. X. circuit of 500 ohms where the voltage has dropped from 16 to 14.4 volts.

Solution: The voltage being 14.4 volts there has been a drop of 16.0 minus 14.4 which is 1.6 volts up to that point. This is 1.6/16 or 0.1 of the whole E. M. F., therefore 1/10 of the total resistance has been overcome or 1/10 of 500 is 50 ohms.

Ohm's law also can be written to state that the resistance which a given conductor offers to the flow of current can be obtained by dividing the E. M. F. which caused the current to flow by the amount of current produced, that is, the resistance in ohms is equal to the E. M. F. in volts divided by the currents in amperes.

Example: The resistance in a certain part of a P. B. X. circuit is such that a current of 0.012 amperes is produced when a battery of 24 volts is connected to it. If this resistance is reduced by 800 ohms, what current will be produced by a battery of 16 volts?

Solution by Formula: **R=E/I** or 24,000 volts divided by 0.012 amperes equals 2000 ohms and this minus 800 ohms equals 1200 ohms. **I=E/R** or 16 volts divided by 1200 ohms equals 0.013+ amperes produced.

Example (2). The loop resistance of a P. B. X. telephone station circuit including the switchboard lamp is 400 ohms. A current of 0.040 amperes is required to light the lamp. What E. M. F. must the battery have? **Answer:** **E=IR** or 0.040 times 400 equals 16 volts.

● The current flowing in a circuit merely represents the amount of the flow, and is quite irrespective of time. To obtain the quantity of electricity that has flowed through a circuit, the value of the current must be multiplied by the time for which it is flowing.

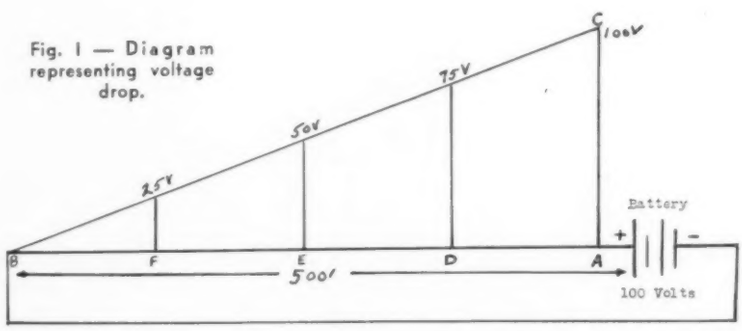


Fig. 1 — Diagram representing voltage drop.

The unit of quantity is the coulomb and is defined as the quantity of electricity conveyed by a current of one ampere flowing for one second. Inasmuch as energy is expended in a circuit or conductor, when an electric current flows through it, energy is known as power, or the rate of doing work, that is, the rate at which energy is expended.

Although electric current is not energy, that is, does not possess the power of doing work, it cannot flow through a conductor except at the expense of energy, and whenever a current is flowing through a conductor, energy is being expended in it. Every part of an active electric current is a seat of energy. This being the case, it follows that in every part of an electric circuit, energy disappears and some other form, usually heat energy is produced in its place.

The unit of electrical power is a unit of electrical work performed in a unit of time, or a joule (volt-colomb) per second, and it is called the Watt, which represents the power available in any circuit in which a current of one ampere is flowing owing to an E. M. F. of one volt. Power is represented by the letter **P.**

● Formulas which are applicable to electrical power are as follows: (1). To find the amount of power expended in a circuit when the value of the E. M. F. and current are known, multiply the current by the E. M. F. or $P=EI$ expressed in watts. To find the current when the watts and E. M. F. are known, divide the watts by the E. M. F. or $I=P/E$. To find the E. M. F. when the watts and currents are known, divide the watts by the current, or $E=P/I$. To find the resistance when the E. M. F. and watts are known, divide the E. M. F. by the watts and multiply the result of the E. M. F. or $R=ExE/P$. To find the power when the E. M. F. and resistance are known, divide the resistance by the square of the E. M. F. or $P=E^2/R$. To find the power when the current and resistance are known, multiply the current squared by the resistance, or $P=I^2R$. This is often called the **I square R** loss.

To find the current when the watts and resistance are known, the current equals the square root of the watts divided by the resistance, or $I=\sqrt{P/R}$. To find the amount of work done in joules, the current is multiplied by the E. M. F. and time.

Example: Using several of the above stated formulas, the protector fuse in a P. B. X. trunk line circuit blows 0.04 seconds after the line wire comes in contact with a 220-volt circuit. If the resistance of the trunk line wire between the protector fuse and the point of contact is 80 ohms, what is the power developed and the amount of work done during the time taken by the fuse to operate?

Solution: (1) $P=E^2/R$ or 220 times 220 equals 44400 divided by 80 equals 550 watts, or the amount of power developed. **Solution** (2) $I=E/R$ or 220 divided by 80 equals 2.75 amperes. **Solution** (3) $J=EIt$ or 220 times 2.75 times 0.04 equals 2420 joules, or the amount of work done.

● When a current of electricity flows through the conductors and apparatus in a P. B. X. circuit, heat is always produced in more or less quantities. The rate at which the heat is produced is proportional to the power expended and varies as the square of the current flowing. This means that if the current is increased to twice its original value, the heat produced will be four times as great.

Heat may be present in two different forms, that is, as sensible and as hidden or latent heat. If it is perceptible in form that can be detected by one or more of the senses, it is called sensible heat, meaning of course, that heat can be recognized by the senses. Latent heat is the heat stored up in any substance due to the internal change that has occurred in the substance itself.

The exact nature of heat is as elusive as that of magnetism or of electricity. It can be visualized only in terms of its effect. About all that can be said is that heat is a form of kinetic energy which manifests itself in physical bodies by such effects as increase in temperature, increase in volume, and change of state. Quantities of heat are measured in British Thermal Units (B. T. U.) B. T. U.'s are usually defined as the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit.

Since the specific (precise) heat of water varies slightly with the temperature a "mean B. T. U." is sometimes defined more precisely as 1/180 of the amount of heat required to raise the temperature of one pound of water from 32° to 212° F. If 100 pounds of water is heated from 50° to 212° F., then, $(212-50)\times100=16{,}200$ B. T. U.'s which are supplied to raise the temperature of the water from 50° to 212° F.

● The thermal energy of one B. T. U. is equivalent to the mechanical energy required to lift a weight of 778 pounds to a height of one foot. Having conceived of heat in mechanical terms as due to molecular motion or vibration, two methods by which it may be transmitted are immediately suggested: (1) The vibratory motion may be transmitted progressively from molecule to molecule by impacts (conduction); or (2) the vibrating masses may be conveyed bodily from one place to another by circulation or mixing within a fluid (convection).

The mechanism of this process may be visualized by assuming that the vibrating molecules set up waves in the ether which travel through space just as light or radio waves. These waves are transmitted, reflected, or absorbed in varying degrees by different substances and surfaces. When they are absorbed, the radiant energy is again converted into sensible heat. These are the three fundamental heat transfer processes. Evaporation and condensation are usually regarded as special cases of convection and conduction.

It may be stated further that all of the phenomena of radiant energy, cannot be explained in terms of a single mechanical theory. In modern physics the wave theory and the corpuscular theory are maintained as alternative description of a process which can be expressed adequately only in mathematical terms. In many respects they are equivalent, and for practical purposes the wave theory provides a very satisfactory conception of the mechanism of heat.

Another unit is called the calorie, it is the amount of heat necessary to raise the temperature of one gram of water one degree centigrade, that is, one degree on a thermometer having its scale divided, as the word centigrade suggests, into one hundred grades or degrees.

The fraction of a calorie absorbed or given out when one gram of a substance changes temperature through one degree, is called the specific (precise) heat of the substance. The specific heat of water is greater than that of any other substance, that is, no liquid or solid requires as much heat to raise the temperature of one gram of it one degree as the same amount of water requires for the same change in temperature. For example, the specific heat of water is 1.000 and that of copper is 0.094, meaning that only 0.094 calories would be required to raise the temperature of one gram of copper one degree centigrade.

● It is an experimental fact that a conductor through which electric current flows is warmed by it. A large conductor with a small current flowing through it, may we warmed so little that the rise of temperature is barely detected, while a small conductor with a large current flowing through it may be heated to the melting point. If the current in a conductor is doubled, the rise in temperature, that is, the meas-

ure of heat liberated, is much more than doubled.

Advantage is taken of the heating effect of the electric current flowing in a conductor to the extent that it is the principle involved in the use of safety fuses placed in P. B. X. power circuits, since the fuses melt and open the circuit when the current rises to a certain predetermined value.

In a large number of pieces of P. B. X. apparatus, the heating effect caused by the current limits the amount of current that is allowed to pass through the apparatus with safety. Steps are taken in the manufacture of all P. B. X. apparatus to limit the temperature rise as far as possible.

For existence for any time of a current of electricity always implies the existence of what is called a circuit. An electric circuit is a system consisting of an E. M. F. and one or more conductors which start from the E.M.F.'s and return to them, that is, in which electricity circulates from a given point (source), around or through a conducting path and back again to its starting point.

The idea of an electric current flowing through conductors comprising a circuit implies a direction of the current. This direction has to be established on conventional grounds. A simple electric circuit is shown schematically in Fig. 2, and in which the terminal of the cells representing the **(Z)** zinc plate, is the active one. The other, **(C)** or carbon plate may be pictured to the mind as merely gathering electricity and delivering it to the conductor. The current in the outer portion of the cells closed circuit flows from the carbon plate to the zinc plate.

It is possible to have a circuit including an E. M. F. of 16 or any number of volts, and also any number of ohms. Such a circuit may be spoken of from the standpoint of E. M. F. as a 16-volt circuit or resistance as a 100-ohm circuit, but neither term can be applied to the current.

The value of an electric current is measured and defined by the quantity of electricity it transfers in a unit of time. It is the rate of transfer of electric quantity, and its value has to be measured in quantity multiplied by units, such as coulomb-seconds, which are more generally known in practice as amperes.

● If a person uses the idea of current transmission by a conductor in speaking and thinking of electric action, he may picture to himself the following representation of the action of a conductor. An electric disturbance is produced in ether, (a sustance that is supposed to pervade all space and to infiltrate the sun and planets) and other waves are set in motion. Ether being resistitutive, it tends to resist the transfer of anything resembling quantity, that is, the elasticity of the ether tends to throw it back on itself.

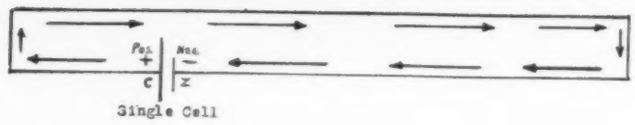


Fig. 2—Simple circuit. Arrows indicate direction of electric current flow as generally accepted in P.B.X. practice.

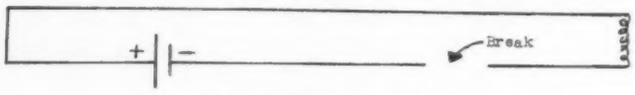


Fig. 3—Open circuit.

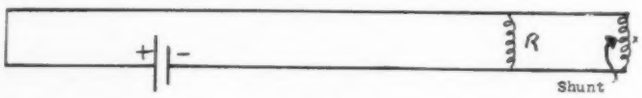


Fig. 4.

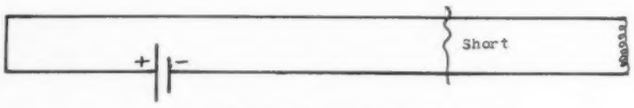


Fig. 5—Short circuit.

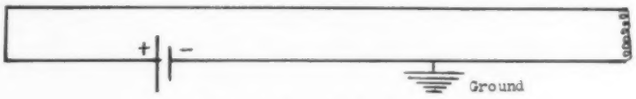


Fig. 6—Grounded circuit.

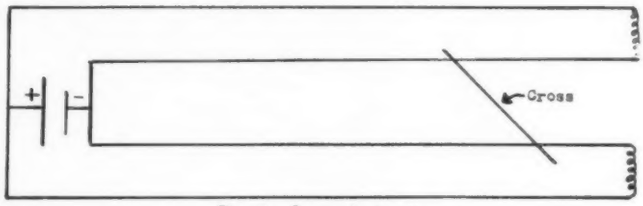


Fig. 7—Crossed circuit.

However, if a tube were opened through the ether, quantities of electricity could be poured through it so to speak, and the choking effect of a resistitutive medium being removed, transfer of quantity could occur. This analogy, perhaps crude, furnishes a clue to a useful presentation of the conduction of electric quantity, that is, of the electric current flowing through a conductor in a P. B. X. circuit, such as a wire of copper which can be pictured as constituting an ether free from the resistitutive effect, and quantities, such as amperes, of electricity can flow through it.

If electric conductivity exists all through the length of a circuit without a break, it is called a closed circuit as indicated in Fig. 2. If a break exists it is called an open circuit as represented in Fig. 3. If as shown in Fig. 4 another unit **"X"** of similar resistance is connected to resistance **"R"** it would be a shunt or by-path for resistance **"R"**, and would cause the current flowing to divide between the two. If, however, a very low resistance compared to the resistance of **"R"** as represented in Fig. 5, be connected across the circuit it would also be a shunt, but of such negligible resistance through which so much of the current flowing would pass as to virtually cut out the parts of the circuit to which it acts as a shunt, and is known as a short circuit. Figs. 6 and 7 represent a grounded and crossed circuit, respectively.

In P. B. X. practices, intentional short circuits, open circuits, grounded circuits, etc., are established under various conditions in order to cause the proper operation of the P. B. X. switchboard, but when they occur and are not so intended to function, these circuit conditions are known as accidental and produce operating troubles.

(To Be Continued)

Cable Splicer's Platform

By J. W. PEYTON

The cable splicer's platform illustrated below was designed by the writer and has been used successfully by him for some time.

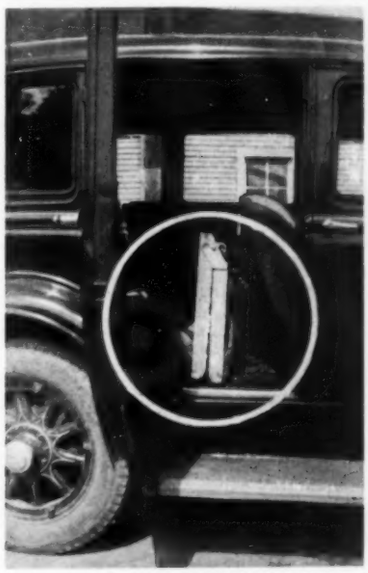
The platform is of electrically welded steel construction. It is hinged in such a way that when the foot rest rope snaps into place the platform cannot unfold.

Platform on cable.

When the platform is opened out and the foot rest rope snaps into place it cannot fold up. These features make the platform perfectly safe.

There is a cast steel grip which folds up and clamps on a messenger ¼" to ¾". It is so designed that the platform will not slip down when it is hanging on a graded span of cable.

The seat of the platform is made of veered lumber and is riveted to the frame. The seat is placed lower than the frame in order to prevent tools from falling to the ground. The platform is hinged with a ⅜" cotter key so that it



Platform folded up and placed in rear of car.

can be taken apart and straddled around a pole if necessary.

When folded up the platform takes up a minimum of space and can be carried in the rear of an automobile. Without ropes the outfit weighs only 28 pounds.

Report of 1934 C.C.I.F. Meeting Available in English

Translation into English of the proceedings of the latest plenary meeting of the Comite Consultatif International Telephonique, (C.C.I.F.) held in Budapest, Hungary, in 1934, has been completed.

As its name indicates, the C.C.I.F. is a consultative, rather than an executive body, which acts in an advisory capacity by making the experience and technique of each member administration available to the others. Its recommendations are prepared in its Commissions of Rapporteurs, who are recognized experts on questions relating to telephonic transmission and the protection of telephone lines against external disturbances as well as operating, maintenance and tariff problems. These recommendations are scrutinized and approved at the Plenary Meetings of the entire body.

The English translation of the original French text has been made by the technical staff of the International Standard Electric Corp. It is contained in one volume of 650 pages with a comprehensive cross-reference index, one useful feature of which is a parallel column, giving for reference he corresponding page number in the French edition.

Among the more important items discussed in the book are: Recommendations of principle concerning telephone transmission, standard reference systems and general rules for the lay-out and design of transmission system (terminal, intermediate and line equipment); simultaneous operation of telephony and telegraphy in cable and coordination of radio telephony and land wire systems.

A series of master specifications for cable, loading coils, repeaters and auxiliary apparatus are included.

Rules are given for protective measures to be taken against high tension interference and electrolytic or chemical corrosion.

One section is devoted to maintenance questions, which are dealt with in considerable detail by descriptions and specifications of suitable measuring apparatus and appropriate testing methods and routines.

Operating traffic and tariff matters are covered by specific recommendations, contained in the fifth and last volume.

An exhaustive bibliography of English, French and German publications, of which over 1000 references are listed, is included in the volume.

This work may truly be said to give a most comprehensive account of modern tele-communication practices. It contains the accumulated experience and knowledge of the foremost telephone experts in the world who have contributed to the work of the C.C.I.F. It should provide a valuable reference for all telephone engineers wishing to keep abreast of the rapidly progressing art of tele-communication.

Copies of the English translation of the C.C.I.F. book may be obtained by writing to Electrical Communication, 67 Broad Street, New York, N. Y. The price of the book is $6.00.

We Beg Your Pardon

On page 36 of the July issue of TELEPHONE ENGINEER, in an article pertaining to the unification of the telephone systems of Mexico, it was stated that the Ericsson Telephone Co. is a subsidiary of International Telephone and Telegraph Corp., and that the Mexican Telephone Co. is a subsidiary of American Telephone & Telegraph Co. This statement is in error and we wish to point out that the Ericsson Company is an independent Swedish telephone company operating in many countries and that the Mexican Telephone Co. is a subsidiary of the International Telephone and Telegraph Corporation and not of the American Telephone and Telegraph Co.

Lays New Cable

The Milledgeville (Ill.) Mutual Telephone Co. is laying underground telephone cable.

The old cable runs east from the telephone office toward the edge of town. The new equipment is being laid underground down the alley to the north. From there it extends under the paving at the Free Press office east to a point south of the George Seng property. From that point it will be laid north to the town limits.

During the height of the floods of last Spring, telephone calls between Springfield and Northampton, Mass., which cost 15 cents, were routed via Boston, New York and Albany, over lines or through the territories of four Bell System telephone companies.

LINE and DESK

RAY BLAIN, Member A. I. E. E., Editor

Q. How deep in the earth should steel tape armored cable ordinarily be buried?

A. This will depend considerable on local conditions but ordinarily 24 inches will be about right.

Q. Does the new type transparent glass insulator present any advantage over the old colored glass type?

A. It is claimed that spiders will not spin their webs under the transparent insulator. These webs sometimes cause leaks to ground during wet weather.

Q. What type of chain lift is considered suitable for pulling storm guys on a toll line?

A. Several different chain hoists are manufactured especially for telephone work and any one of them will be found entirely suited to your needs.

Q. What number of answering jacks is it customary to mount on a single switchboard panel?

A. When the jacks are mounted 10 per strip usually 80 to 100 are placed on one panel and when they come 20 per strip 100 or 120 per panel.

Q. Why is a battery cut-off key necessary on a PBX switchboard?

A. This is generally considered necessary as a safety measure so that battery may be removed from a switchboard at night when certain branch stations are connected direct through the PBX switchboard over trunks to the main exchange.

Q. What is the so-called "Endless Weave" cable grip used for pulling-in cable?

A. This is a flexible woven wire grip in which the ends are embedded in a solid steel pulling eye. This method leaves the end of the grip smooth with no frayed ends which might cause injury to workman's hands.

Q. What battery voltage is ordinarily applied to switchboard lamps?

A. The voltages most commonly used for switchboard lamp operation are 12, 24 and 48. Sometimes, however, lamps with a voltage as low as four are used when connected in series in a circuit with other apparatus such as a relay.

Q. What type of reinforcing iron should be used in the roof construction of a concrete manhole?

A. Old steel messenger cut to suitable lengths with hooks bent on each end will be found ideal for this purpose. A quantity of short lengths of old messenger can generally be found around the average exchange which may be used for this purpose and save the cost of the regular reinforcing iron.

Q. When the appearance of southern pine poles is considered objectionable what action is advised?

A. This may be painted with a good grade of aluminum paint. A brush may be used for this purpose though a paint spray is more convenient and does a much better job. Creosoted pine poles painted in this manner present a very pleasing appearance and should not be objectionable to anyone.

Q. What is considered the modern method of staking out pole line and locating anchors?

A. Many construction men still use sighting rods for this purpose though the method is slow and not always accurate. A small transit which is easy and convenient to use can be purchased at a small cost and will be found ideal for this purpose. This little instrument also serves numerous other useful purposes around the telephone exchange.

Q. What treatment can be given sectional steel manhole forms to prevent concrete from sticking to them?

A. First they should be cleaned thoroughly with a wire brush and then painted with warm paraffin. After being used a few times the old paraffin should be scraped off and a new coating applied. This method will keep forms in good condition at all times and cause them to be removed easily after the concrete has set.

Q. What is the necessity of an extra non-inductive winding on certain telephone relays?

A. When a relay must be connected in series with a talking circuit, the inductance of its winding would choke voice frequency current and it is necessary that this current be by-passed around the relay. This can be accomplished by shunting the relay with a suitable capacity but the more economical and efficient method is to wind the relay with three wires, two or which form a non-inductive winding and the third the magnetizing winding.

Q. When ducts enter the basement of a building from a nearby manhole should they be sealed in the basement or the manhole?

A. We would recommend that all ducts both vacant and in use, be sealed in the manhole and the basement. No chances should ever be taken of flooding a basement. Special plugs can be obtained at a reasonable cost which securely seals ducts and quickly. Vacant ducts may also be sealed with wooden plugs wrapped in cloth and driven into them. Occupied ducts can be closed with oakum and sealed with cement made of equal parts sand and plaster of paris.

Q. Is it considered more desirable to place the ladder racks on the side or the top of a light transportation truck?

A. Both methods are used though it is believed that many new trucks are now equipped with the top mounting ladder rack. On this truck the drop wire reel is on the side. The top rack has more room for hauling digging tools and a crossarm or two may also be hauled when necessary. The top rack gives better vision for the driver and some claim that with the ladder rack on the left side of the truck there is a possibility of a truck upsetting on the right side and trapping the driver in the cab.

Q. Is the arrangement of providing numbered hooks in the switchboard room for the operators to hang their headsets on considered satisfactory?

A. This system is seldom used at the present time and is not considered entirely satisfactory. The winding of cords and hanging them on a hook always causes considerable wear. They also fall from hooks frequently causing serious damage to transmitters and receivers. Headset wall cabinets are considered more desirable than any other method for proper storing of operators headsets when not in use. Some companies are now providing a steel locker for each operator where they

(Please turn to page 36)

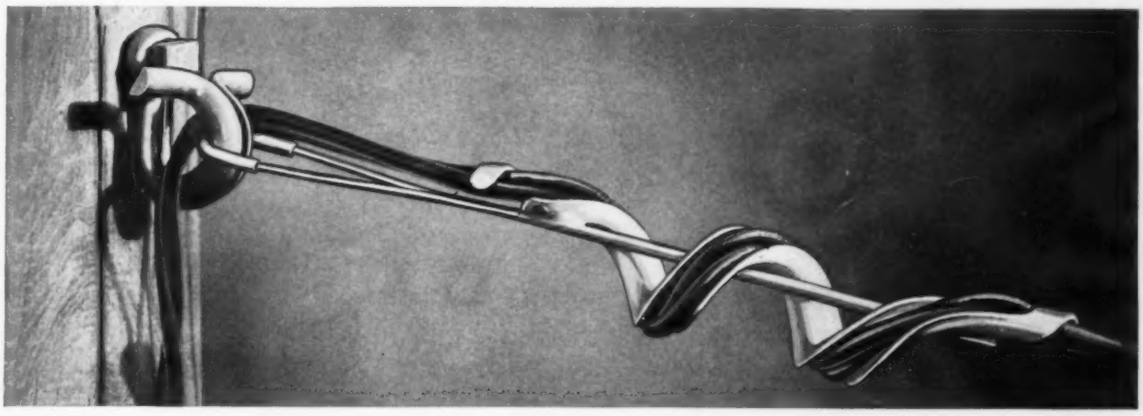
The Manufacturer's Bulletin Page

KEARNEY
Telephone Equipment News

NEW PRODUCT INFORMATION

Latest News | St. Louis, Mo., August, 1936 | Phone Copy

NEW DROP WIRE GRIP USES SNUB PRINCIPLE TO GIVE MAXIMUM GRIP WITHOUT DAMAGE TO INSULATION



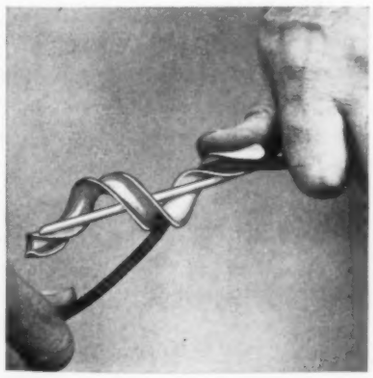
Telephone Men Like Feature of Easy Installation and Removal of Conductors

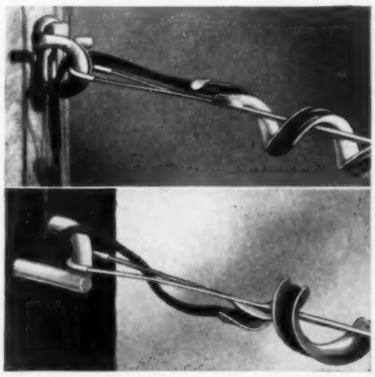
Free Trial Sample Now Being Offered to the Readers of This Book

A NEW DROP wire clamp made in a unique spiral form and capable of standing a strain that will hold the conductor up to the breaking point, without damage to the insulation, has gained the approval of hundreds of operating men.

Specially Designed Spiral

The holding power of the Kearney Drop Wire Grip is obtained by a snubbing principle in which the wire is wound in the specially designed, grooved spiral as shown in cut below. Eight inches of frictional contact with the clamp is thus obtained to give a positive grip on the wire and insulation, alike.





Two types drop wire hooks

The grip is adaptable to either paired outside drop (P.O.D.) or to parallel straight laid type of drop wire. It holds effectively on either of these conductors and may be quickly and conveniently installed or removed from them.

Free Trial Offer

As a means of introducing the advantages of this grip, the Kearney Corporation will send you a sample grip without obligation. Merely address the Telephone Department of this company.

Two Special Hooks

The drop wire and drive hooks shown above are now available at reasonable cost. Prices and information will be sent on request.

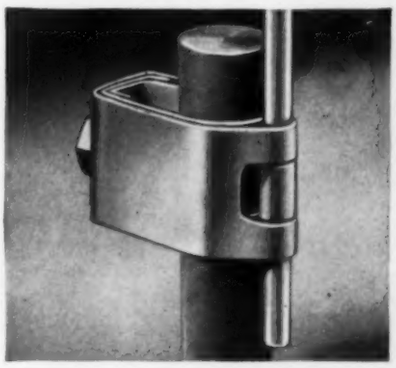
REVOLUTIONARY DESIGN OF GROUND CLAMP

Affords Greater Grounding Contact

The special "wrap-strap" design of the new Kearney Clamp-Tite affords 34% of wire surface area under clamp in contact with it, and 44% of rod surface area under clamp in contact with it to assure maximum bond between ground rod and ground wire.

Under pressure this clamp shapes itself to conform with rod and wire and has resiliency enough to compensate for expansion and contraction and assure a tight, permanent fit even under conditions of severe vibration. For further information about their advantages and economical cost, address:

JAMES R. KEARNEY CORP.
4230 Clayton Ave., St. Louis, Mo.



Editorial « « «

Another Major Improvement

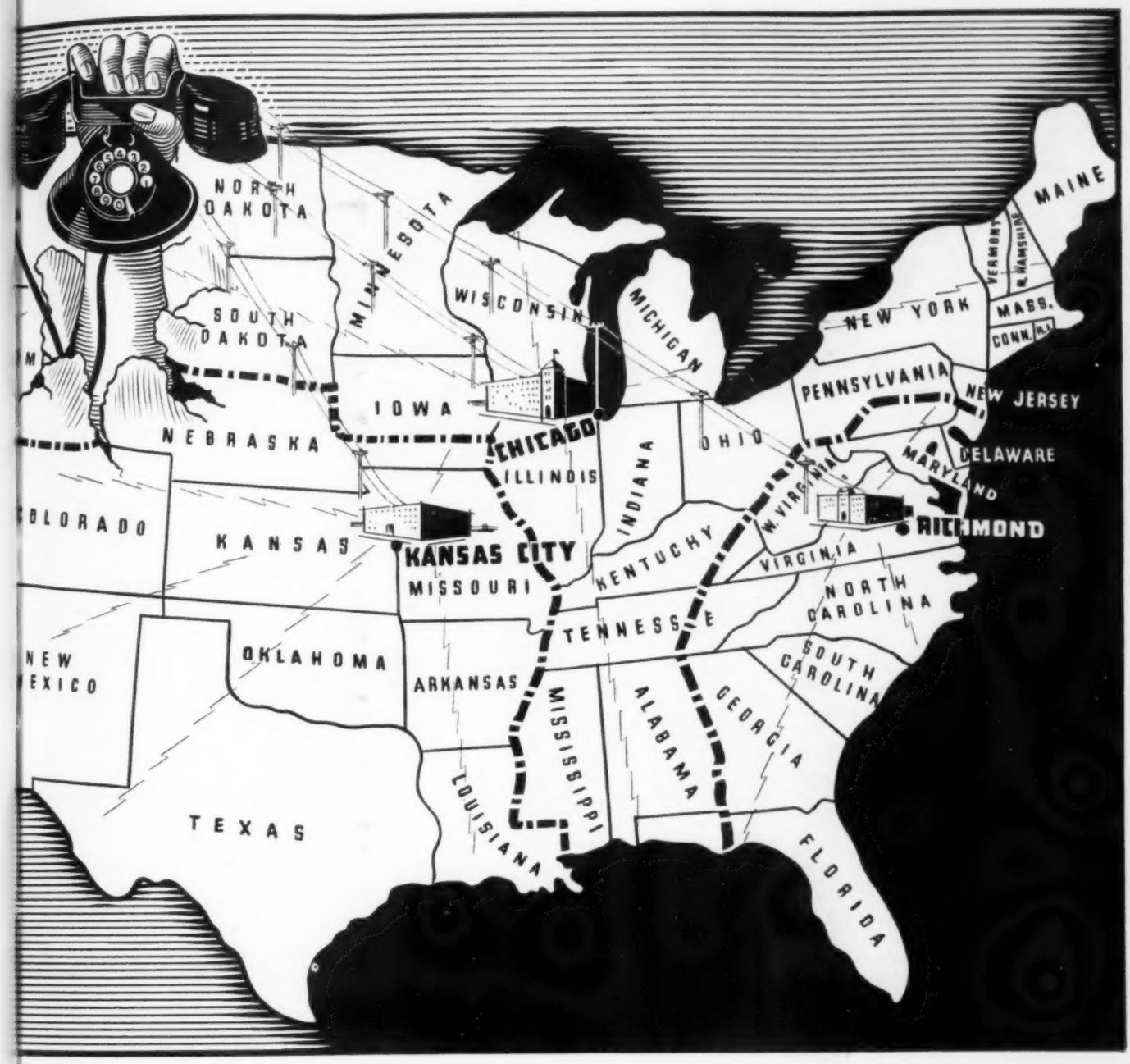
In line with its progressive policy of adopting the latest and up-to-date journalistic developments, TELEPHONE ENGINEER inaugurated its new varnished front and back covers with the July issue.

We are happy and pleased to be able to add this unique improvement to the telephone industry's only national monthly trade publication. The varnished covers have attracted the attention of and have met with immediate favorable acceptance by telephone men everywhere — both operators and manufacturers. This modern feature gives the industry a publication having maximum "eye appeal" for the reader, thereby adding to its potency as an advertising medium. The varnished covers represent the sixth major improvement made within the past three years. In rapid succession the following features have been inaugurated by TELEPHONE ENGINEER:

1. New and modernized inside typography.
2. Improved quality in editorial content, designed for the manager, commercial man, engineer and maintenance man, giving the publication an all-around appeal.
3. Use of heavy enamel paper stock throughout the magazine, improving the appearance of reading and advertising matter.
4. Modern front cover void of all advertising, a predominating trend in the publishing industry.
5. Issuance of the most complete and simplified Buyers' Guide and Manufacturers' and Distributors' Directory (incorporated in January issue of each year) ever presented to the industry.
6. The varnished front and back covers.

While these improvements have been adopted at a considerable expenditure of money and effort, the foremost thought in the publishers' mind has been to give the industry a modern up-to-date and progressive publication which it deserves. That the industry has appreciated this effort is shown by the fact that in the first six months of 1936 there was a gain of 11.7 per cent in TELEPHONE ENGINEER'S circulation and a 101 per cent increase in its advertising volume over that of the first half of 1933. As has been the improvement in TELEPHONE ENGINEER in the past three years, these increases have been steady, month after month, each showing a gain over preceding ones.

We treasure this mark of appreciation and confidence on the part of our readers and advertisers. We pledge again that in the future we will, to the best and to the extent of our ability and facilities, maintain our policy of progressiveness in giving the industry the most up-to-date publication.



Y SERVICE ON THE FOLLOWING ITEMS: Lead cable—line wire—drop wire—poles—
ets—wood pins—pole steps—construction tools—belts and climbers—pole line hardware—dry
batteries—cable terminals—switchboard protectors—substation arresters—a complete range
luding magneto and central battery, manual and automatic types—etc., etc.

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AUTOMATIC ELECTRIC SALES COMPANY, S. A.
22 Rue du Verger, Antwerp, Belgium
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CANADIAN TELEPHONES & SUPPLIES LTD.
284 King Street West, Toronto

Representative Attendance at Michigan Convention

A representative group of Michigan telephone men and women attended the first annual convention of the revived Michigan Independent Telephone Association, held on July 29 and 30 in Lansing.

The majority of those attending the convention represented the smaller operating companies of the state, and they gained considerable value from the interesting and practical program of the meetings.

The following were re-elected officers of the convention for the ensuing year:

President, Dr. O. M. Vaughan, South Haven, president, Tri-County Telephone Co.; vice-president, W. J. Melchers, Owosso, vice-president and general manager, Union Telephone Co., and secretary-treasurer, Mrs. Jane Thompson, Lansing.

The following directors were elected:

Director from District No. 1: H. R. Christianson, Muskegon, vice-president and general manager, Michigan Associated Telephone Co.

Director from District No. 2: Chas. W. Cheeney, Chesaning Home Telephone Co.

Director from District No. 3; B. R. Sage, Central Lake, general manager, Traverse Bays Telephone Co.

Director from District No. 4: P. E. Taylor, manager, Pickford Telephone Co.

President O. M. Vaughan opened the convention by introducing Paul A. Martin, publisher of the Michigan State Journal, who gave the address of welcome. Association Vice-President W. J. Melchers, Owosso, gave the response. In his address Mr. Melchers traced the history of the Michigan association which was organized in 1897 and operated until 1909.

Mrs. Jane Thompson, secretary, presented her annual report stating that the association had a membership of 102 and also reported that the association was in good financial condition.

President Vaughan then presented his annual report, in which he discussed several problems confronting the telephone industry. He urged every telephone company in the state to become associated with the association. In closing his address, Dr. Vaughan said:

"In order to have a successful association it requires the hearty support of all. It is so much better to be prepared by cooperating together than to wait until we are up against some problem and then try to organize. Remember that this association was not organized to benefit a few, but was created to be of assistance to all telephone companies of Michigan, and if we all work together on this basis there is nothing but a bright future for the Michigan Independent Telephone Association."

C. C. Deering, secretary-treasurer, United States Independent Telephone Association, gave an address on "The Independent Telephone Company and the Indpendent Telephone Industry." Mr. Deering traced the development of the Independent industry throughout its life and told of the composition of the Independent group, including operating companies, manufacturing companies, the telephone press and state and national associations.

"Depreciation" was the subject of an address by Jay S. Hartt, consulting engineer of Madison, Wis.

The second day of the convention was opened with a round table discussion in charge of R. C. Smith, Goshen, Ind. Many subjects were discussed and the meeting was participated in by Claude D. Keller, Allen; F. B. Newman, Muskegan; C. W. Cheeney, Chesaning; W. A. Smith, Newport; Mr. Melchers and T. M. Platt, Alpena.

Following the round table discussion, F. B. McKinnon, president, United States Independent Telephone Association in an interesting address emphasized the activities of the national association as related to telephone operating companies. He discussed several subjects, including taxes, rural electrification and the activities of the Federal Communications Commission.

Louis M. Pitcher, Dixon, Ill., gave an address on "What the Future Holds for the Telephone Business", discussing technical developments, relationship with the Bell system, public relations and taxes.

"The Commission's Viewpoint" was the subject of an address given by Harold J. Wapples, vice-chairman, Michigan Public Utilities Commission. After describing the commission's work, Mr. Wapples said that its policy "is to be of assistance to telephone companies and to do all it can to advance their best interests and those of their subscribers".

The last afternoon of the convention was devoted to three addresses, one on "Taxes" by Melville B. McPherson, chairman, Michigan Tax Commission; another on "Rural Electrification and Its Affect on Independent Companies" by E. J. Arnold, division transmission and protection engineer, Michigan Bell Telephone Company, Saginaw, and an address on the subject "Unemployment and the Social Security Act" by William Haber, Michigan Works Progress Administration, Lansing.

R. H. Coyne, Independent Pioneer, Passes Away

It is with regret that we announce the death of R. H. Coyne, Independent telephone pioneer and one of the industry's prominent leaders. Mr. Coyne passed away Tuesday, August 4 at Edgewater Hospital, Chicago.

Mr. Coyne began his telephone career in 1902 as an employee in the stockroom department of the Kellogg Switchboard and Supply Co.

Through his initiative and understanding of the business, Mr. Coyne received rapid promotion and following a few years in the sales department, to which he was transferred, he was appointed as the company's Wisconsin representative in 1910.

In 1915 he was placed in charge of Kellogg's San Francisco branch as West Coast Manager. He remained in this position until 1919 when he was appointed special representative in South America.

In 1921 he was transferred to this country and placed in charge of special sales and installation work in connection with large operating companies.

Mr. Coyne remained in this capacity until February 15, 1929 when he left the manufacturing business and with a group of associates formed the Middle Western Telephone Co., controlling the Middle States Telephone Co. of Illinois; La Crosse (Wis.) Telephone Co. and Warren (O.) Telephone Co.

From 1929 until his death Mr. Coyne devoted his time to the affairs of these companies. For the past few years he served as a director of the Kellogg Switchboard and Supply Co.

Postage Stamp Commemorates Telephone Cable Opening

The first postage stamps ever printed, so far as is known, to commemorate the opening of a telephone service have recently been issued by the Australian Government to mark the establishment of telephonic communication between the mainland of Australia and the island state of Tasmania through a submarine telephone cable 169 miles long.

The stamps are of two denominations, two-pence in red and three-pence in blue, identical in general design. A symbolic figure standing on a sea-shell in the center of the stamp holds in one hand a trident and with the other supports a cable. In the foreground, at the feet of the figure, are the words, "Commemorating the opening of submarine telephone communication to Tasmania, 1936."

Michigan Bell to Spend $30,000,000

Approximately $30,000,000 will be expended by the Michigan Bell Telephone Co. this year for operation of its service, extension and maintenance of plant, taxes, interest, and the purchase of supplies and material essential to the conduct of its business, according to company's present estimate for 1936.

Large quantities of the supplies and building materials required by the company this year will be represented by expenditures in Michigan. These items include furniture, oil, gasoline, cleaning materials and equipment, paper, tons of printed matter, newspaper advertising space, electric light and power, automobiles, trucks, batteries, tires, trailers, transportation, lodgings and meals for traveling employees, paint, brick, lumber, cement, stone, steel and other building materials, plumbing fixtures and almost numberless other products. Almost every business and industry in the state will benefit.

The telephone plant needs of the company this year call for the purchase of 19,000 telephone poles, 4,000 crossarms, 6,500 feet of duct in clay conduit, 400,000 feet of strand wire, 150,000 pounds of bare copper wire, 68,000,000 conductor feet of wire in lead-covered cable, and 65,000 handset telephones.

Michigan Bell Accepts Rate Reductions

Reductions in telephone rates and charges, ordered by the Michigan Public Utilities Commission June 30, is agreed to by the Michigan Bell Telephone Co., which sent the commission a letter accepting the order but reserving the right to contest the rates if returns prove inadequate. The letter, signed by G. M. Welch, president of the Michigan Bell, stated that the company would withdraw its suit now before the U. S. District Court at Detroit, "and thus terminate all existing litigation" in the rate controversy.

The letter asks that, if the experience of the future indicates that the new rates are not fair to the company, an expeditious adjustment be made.

100% Underground Cables

The Farmers Cooperative Telephone Co. of Everly, Ia., has completed the work of laying cables in the northeast part of town. Everly is now almost 100 per cent equipped with underground cables.

More than 25,000,000 copies of telephone directories are distributed annually to Bell System subscribers.

MASTERGRIP ANCHORS

Save Installation Time And Costs By Meeting *Four Vital* Requirements

1 • POWER TO HOLD

MASTERGRIP Anchors are designed to offer strength, efficiency and simplicity. Tests prove their strength; design makes their simplicity; and use marks their efficiency. Try MASTERGRIP Anchors and be convinced of all three.

2 • EASY TO INSTALL

MASTERGRIP is installed quickly, at any angle, in any type of soil or under water. Drive to the required depth (larger sizes use a 3" hole), then a pull expands the blades into undisturbed soil, giving the greatest possible holding power.

3 • LIGHT IN WEIGHT

MASTERGRIP ranges in weight from 2 to 12½ lbs., yet it safely holds strains of 2000 to 30000 lbs. Since 85% of the surface area of MASTERGRIP holds against undisturbed soil, a minimum of metal is required to hold maximum strains.

4 • LOW IN COST

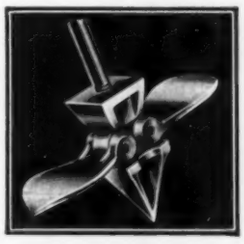
MASTERGRIP Anchors cost less because their great holding power, efficiency, easy installation and light weight make them the economical anchors to use. You get more strain per anchor dollar when you use MASTERGRIP Anchors.

MASTERGRIP THREE-WAY

MASTERGRIP H5 small three-way, weight 3½ lbs., is designed for quick installation, handling strains of 7000 to 11000 lbs. Drive the anchor down a 3" pilot hole, put on the strain. The entire operation takes only a few minutes.

MASTERGRIP G4 medium three-way will handle strains from 8000 to 13000 lbs. This efficient anchor weighs only 6¼ lbs. and is driven down a 3" pilot hole. Undisturbed soil meets 85% of the anchor surface. This means high efficiency.

MASTERGRIP F2 large three-way is designed for heavy strains. In sand 12000 lbs.; 19000 lbs. in ordinary soils and 24,000 lbs. in firm soils. This anchor weighs only 10 lbs. A 4" pilot hole is used to put the F2 to any desired depth.



MASTERGRIP TWO-WAY

MASTERGRIP O5 small two-way is driven into place and will take strains ranging from 2000 to 6000 lbs. O5 weighs 2¼ lbs. Rod size ½" to ¾". Just two moving parts.

MASTERGRIP M4 medium two way also drives into place. Holds strains from 4000 to 8000 lbs. M4 weighs only 3¼ lbs. Rod size ½" to ¾".

MASTERGRIP L2 large two-way handles strains from 9000 to 20000 lbs. and weighs 5¾ lbs. It is driven down a 3" pilot hole. Rod sizes from ⅝" to 1". Simple assembly.

• MASTERGRIP KABLE KING •

Ideal for rural lines and light strains.

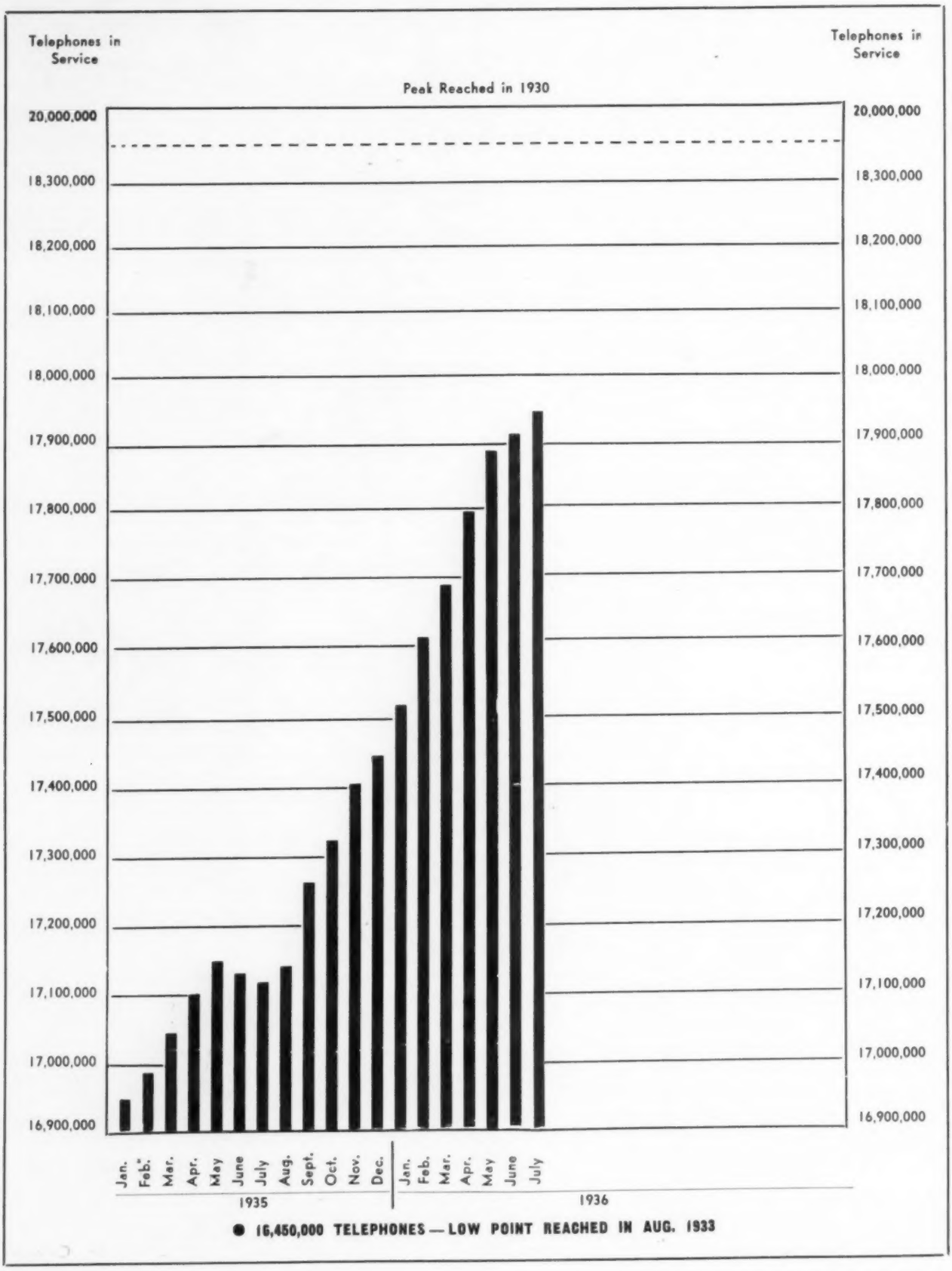
MASTERGRIP KABLE KING, rodless drive anchor, is designed for use with a cable. Simply attach the cable, set a ¾" tube on the anchor head and drive into place. Tests show satisfactory strains of 2000 lbs. in sandy, 4000 lbs. in ordinary and 6000 lbs. in firm soils. Kable King weighs only 2¼ lbs. You will be pleased with its easy installation and excellent results.

WRITE YOUR JOBBER OR

THE AIKEN
MASTERGRIP
ANCHOR CO., INC.

114 N. Seventh St., St. Louis — 63 E. Lake St., Chicago

Monthly Telephone Station Barometer



Flays "Snooping" on Telephone and Telegraph

In a recent issue the Ohio Telephone News reprinted a newspaper editorial discussing interference with the secrecy of telephone and telegraph wires by congressional committees, which should be of interest to telephone men everywhere. The editorial, which follows, is from a recent issue of the *Mt. Vernon News*.

"Resentment over the Black lobby investigating committee's wholesale seizure of records of telegraph companies in the course of its inquiry into lobbying activities of certain concerns has been expressed by some members of the committee as well as by some members of congress.

"These critics question the legality of certain procedure. And well they might. Government prying into private business has gone about far enough. Of course, there are occasions when it is necessary for agencies of government to subpoena records in order to get at the bottom of affairs under investigation, but wholesale seizure of telegraph records of private messages is going a bit too far.

"Agents for various government bureaus are going about the country demanding access to records of private concerns under one pretext or another. Sometimes they have no authority in law for such action.

"Private corporations are being bombarded with questionnaires in which they are asked to detail their business activities in the slightest detail. A horde of government employees are prying into affairs of businss concerns and individuals.

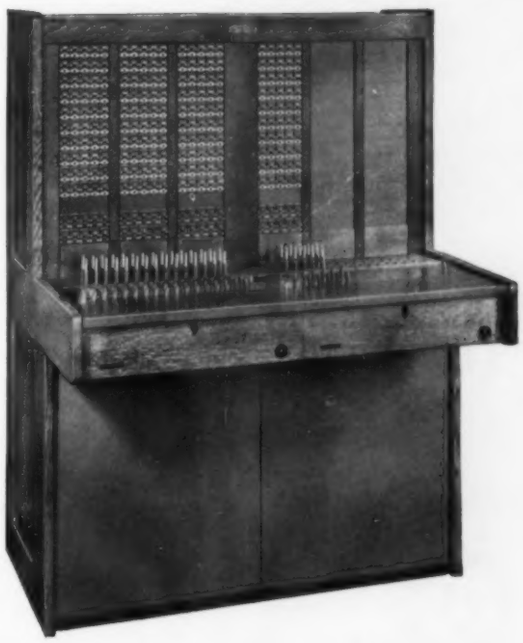
"If things keep on at this rate it won't be long until no corporation or an individual will be able to protect his business and personal secrets. It is only a step away from these activities to tampering with the mails, opening private letters with impunity and examining their contents, and spying in other methods upon the activities of citizens of the country.

"Prying activities now are being conducted with the claim that what is unearthed is for the public good, but is it not easy to see that such activities can degenerate into political oppression? In fact, there is some evidence now to indicate that government information secured from private concerns for legitimate purposes is being used as the basis for political reprisals.

"Is free America threatened with conditions like which prevailed in czarist Russia and some other of the European countries wherein a man dared not speak or write freely for fear of being trapped by a political secret service?"

LEICH

Magneto Switchboards



2 POSITION, STEEL FRAME, SWITCHBOARD

LEICH magneto switchboards are built in various sizes to meet the conditions of the smaller exchanges. One and two position switchboards, larger than 50 lines, have a steel frame carrying all the apparatus and woodwork. Built to last a lifetime. All equipment has been redesigned making it possible to replace ferrules and other parts subject to wear easily.

LEICH switchboard drops are of the plug restoring short trigger type, very sensitive and positive in operation. The drop coil may be removed without disturbing the armature adjustment or any other part. The jack ferrule is readily replaced from the front of the board, a one man job.

LEICH switchboards are noted for the accessible mounting of equipment and excellent wiring.

Make your next switchboard a LEICH for dependable low priced service.

LEICH ELECTRIC COMPANY
GENOA, ILL.

TELEPHONE APPARATUS BACKED BY 28 YEARS' SERVICE

Old Leather Diaphragm Telephone Found

"Hello!" said Duane Moffit, of Tipton, Ia., into the old style telephone, which was really a forerunner of the modern microphone, and Fred B. Wilson cocked his ear to receive the words at the other end of the line. For this is the way they used to telephone in Cedar county, Iowa, some 50 years ago.

These two old telephones were discovered by Mr. Wilson, Tipton furniture dealer, in a dark corner on the second floor of his store. It was not until he had inquired among some of the older residents of the city that he discovered what the two frame-like structures had been used for. It was then recalled that these telephones, many years ago, connected the furniture store with a residence some six blocks away. They were thought to be the first telephones in Cedar county.

Communication was always established between the store and the home and the services of "central" were not needed. To "ring," it was necessary only to tap the leather diaphragm with a pencil or other light object.

At about the same time a single line was run from Tipton to Cedar Bluff, nine miles to the west. Local residents gathered about the telephone on the occasion of a band concert at Cedar Bluff, awed and amazed by the fact that they could hear the music nine miles away.

Telephone Company Victor In Death Suit

Continuance of a $25,000 death suit against the Rochester (N. Y.) Telephone Corp. hinged on study of three decisions handed down by the Court of Appeals.

The high court yesterday afternoon, in a 4 to 3 decision, held the telephone company's contract with subscribers limiting its liability for interruption of telephone facilities is not against public policy.

George R. Hoffenberg, lawyer for the plaintiff in the suit, said he could not tell whether the suit could be continued until he studied the three legal opinions of the court.

The plaintiff, Lewis E. Emery, claims his daughter, Kathleen, 7, died March 8, 1933, of scarlet fever because he could not "raise central" to call a physician.

Ecuador is the only country in South America that has no dial telephones.

HEAR YE! HEAR YE! HEAR YE!

THE ILLINOIS telephone clan will gather in convention on September 17-18 at the Hotel Pere Marquette, Peoria, Ill.

PREPARATIONS have been made for a grand reunion. You will want to renew old friendships and make new ones.

THERE WILL BE speakers of national reputation on many subjects of interest to you.

THERE WILL BE a bigger and better Traffic Conference where the many changes in operating practices will be explained and a well planned round table discussion will be held.

A GRAND BANQUET with high class entertainment and a fine orchestra for dancing will be provided.

HOTEL RESERVATIONS should be made at once.

BOOK REVIEW

INDUCTIVE COORDINATION OF ELECTRIC POWER AND COMMUNICATION CIRCUITS, by L. J. Corbett. Price, $3.00. Order through TELEPHONE ENGINEER.

In this book the author has concentrated the results of his practical experience of several years in the field of inductive coordination, together with the results of studies on the theory involved, by himself and by technical committees of which he was member or chairman. The combination of an experience of several years in university teaching, between longer periods of practical engineering work, is responsible for the viewpoint from which the book is written—full appreciation of the theoretical principles tempered by the practicality of actual conditions.

A concentric method is used in the presentation of this subject involving many inter-related factors. The elements of the problem are first discussed in a broad way, together with the factors involved. The several features are then treated in greater detail — transpositions and their coordination; power system wave shape; causes of the harmonics which affect it, particularly the exciting current of transformers and bank connections; the flow of residual currents in power systems and their control, and the effects of mercury arc rectifiers, now becoming so important in electric railway service and radio broadcasting. Voice and noise levels and losses are considered with their effects on the coordination problem. Typical values of involved factors are given, and various remedial measures for the correction of unsatisfactory inductive situations are described.

By the aid of clear and explicit diagrams, the courses of the elusive residual currents, as affected by equipment and connections, are analyzed.

The treatment is not mathematical, emphasis being placed upon giving a clear physical picture of what goes on in the various circuits and pieces of apparatus. However, it presupposes a general knowledge of the part of the reader of the general principles of electrical engineering.

In appendices, summarizing formulas relating to electric and magnetic induction are presented, by which the induction on communication conductors in proximity to power conductors may be checked. A rather full bibliography is included, and an extensive index renders the matters treated easily accessible.

Training Supervisors and Key Men

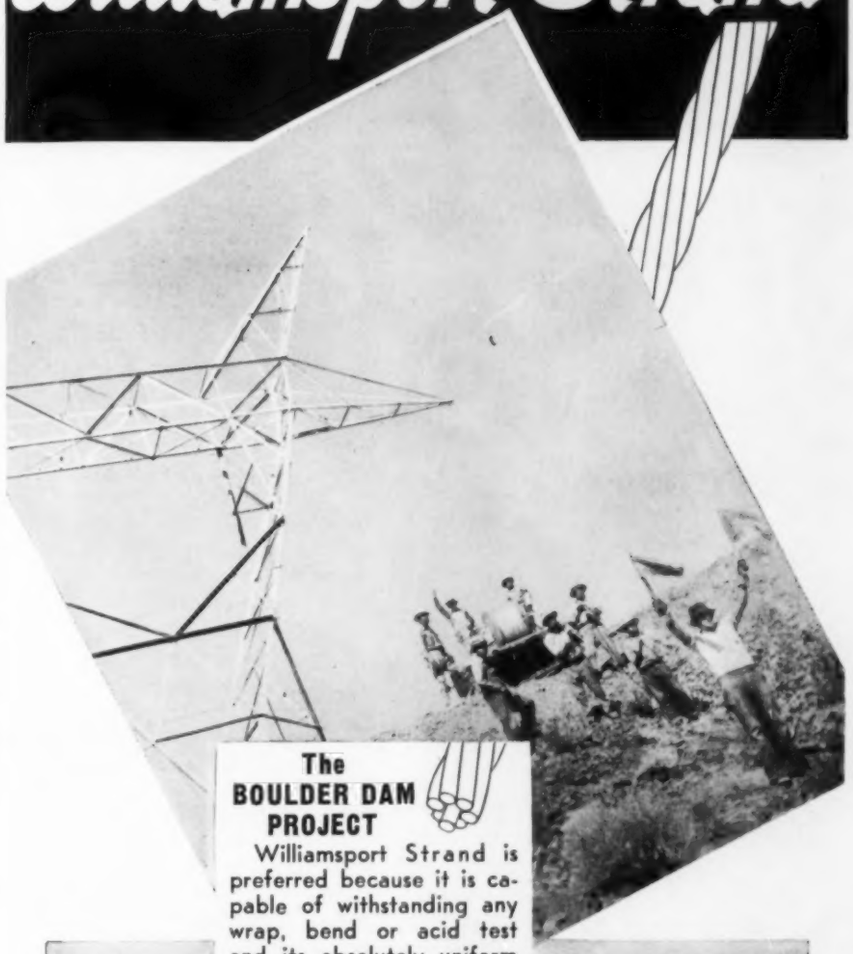
The growing attention being given to employer-employee relations has served to focus attention on foremen and other supervisory employees because of their key position between the management and the rank and file of the organization. This explains why, according to a report recently issued by the Policyholders Service Bureau of the Metropolitan Life Insurance Co., increasing emphasis is being placed on the training of such supervisors as foremen and other "non-commissioned officers" of managerial staffs. A report of the survey, entitled **Training Supervisors and Key-Men,** presents an outline of the practices of 85 companies that have inaugurated such training programs.

A clearly defined purpose is essential to the success of training programs, the report points out. Analysis of the training methods of the 85 companies shows that there are three predominating objectives: (1) providing foremen with an opportunity to acquire information, (2) helping them to think clearly about their jobs and (3) developing ability in doing what is required of them. Methods of training discussed in the report vary from the studied informality of the "conference" method to schedules of lectures on such subjects as economics, psychology, time study and cost accounting, also on company organization and history, products and markets, plant policies and practices. The report, referring to discussions used in connection with training lectures, states that it has been found that information acquired through such methods is better understood and more readily accepted.

The essentials for success in a program of foreman training, according to information in the report, are active interest from the management, a competent leader, a carefully selected group, practical subjects for discussion. The report states that there is difference of opinion as to the possibility of measuring results of training programs. Some companies however, point to specific improvements in departmental production, to changes in attitude of certain foremen, or to the fact that trained foremen have developed faster as a group than those who have not received training.

The report also discusses methods of planning a training program, and the costs of a training program. The details of the practices of seven companies are outlined at some length. Copies of this report are available on request to the Policyholders Service Bureau, Metropolitan Life Insurance Co., 1 Madison Avenue, New York City.

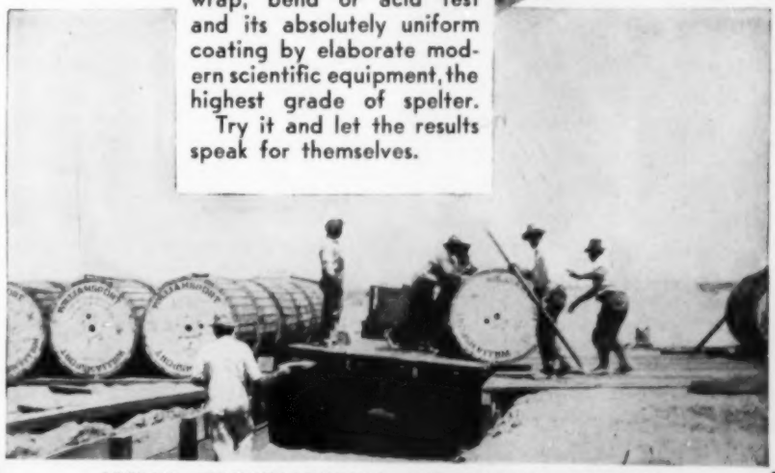
GET OUR PRICES ON
Williamsport Strand



The BOULDER DAM PROJECT

Williamsport Strand is preferred because it is capable of withstanding any wrap, bend or acid test and its absolutely uniform coating by elaborate modern scientific equipment, the highest grade of spelter.

Try it and let the results speak for themselves.



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20 N. WACKER DRIVE, CHICAGO, ILL.
National Distributors

WILLIAMSPORT WIRE ROPE CO.

122 S. Michigan Ave., Chicago, Ill. Williamsport, Pa.
Other Offices in All Principal Cities

BETTER PLIERS

● Klein Pliers are made for the man who needs or appreciates a remarkably fine tool.

From the careful inspection of the alloy tool steel made to the most exacting specifications—

Through the old craftsman methods of individual manufacturing and individual heat treating—

To the final steps of rigid inspection and testing, each pair of pliers that carries the Klein trademark represents the maximum in plier quality.

Klein methods viewed in the light of modern mass production are necessarily more costly.

On the other hand, for a man who demands a plier of Klein quality there is no way to produce it except the Klein way.

Mathias KLEIN & Sons
Established 1857 Chicago, Ill. U.S.A.
3200 BELMONT AVENUE, CHICAGO, ILL.

Independents Asked to Lead Industrial Liberty Group

● The appalling rate at which all nations are drifting toward socialization of not only public utilities — socalled "natural" monopolies—but also all gainful pursuits, is one of the gravest economic problems of our time. Recent events in some of the countries of the old world, where various factions are exterminating each other over property and control of industries, vividly show the natural result of such drifting.

Those who have studied history of past fallen civilizations are beginning to fear that the tendency toward centralization of industrial power in this country since the World War is bound to lead to world socialization.

Business men, such as the pioneers of Independent telephony prior to 1910, before the selective-privileging public utilities boards were created, did not require the aid of the Army and Navy or the State Militia to develop the wealth of our country; yet now we are standing supinely by while the control of this vast wealth is being taken from us and regimented into what many fear may be used as an instrument for the destruction of our freedom and our present civilization.

One of the clearest analysis on this subject probably ever written has recently been published under the caption "Industrial Liberty—Its Effect on National Recovery and Advancing Civilization", by Henry Shafer, the well-known pioneer Independent telephone organizer and manufacturer.

● This booklet outlines the rise through freedom of industry and fall through governmental regulation of earlier civilizations from the most remote time of record, and then cites the marvelous development of Independent telephony under industrial liberty. The booklet gives numerous incidents which many of the telephone pioneers will recall, that prove conclusively the advantages of freedom of industry and outlines the story of Independent telephony as a guide out of the morass through which we are being driven by our governmental leaders.

As the large mass of the people—the voters—always fearlessly follow a battle-scarred general or "captain" rather than the commands of a second lieutenant, so Mr. Shafer, in his analysis of human nature, suggests as leaders in the fight for Freedom of Industry, the financially-scarred pioneers of Independent telephony, or the former local store owners now in the "chain gang" (the chain stores) and the like, as he believes that they can enlist a far greater volunteer army of captains of industries throughout the United States than can be drafted by those in charge of existing organizations such as the National Manufacturers' Association, the United States Chamber of Commerce, the National Bankers' Association and others having the stigma of subserviency.

● Everyone now-a-days knows that under existing laws—through commissions and bureaus — those elected to governmental offices have virtual control of nearly all gainful pursuits, and that naturally they would not be apt to allow real freedom of industry without strong pressure by aroused public opinion; therefore it is suggested that business owners and ex-owners, inventors and the coming generation who are not in the present blutocracy, organize a non-political "awakened force" of public opinion to convert those elected to office to a policy of Freedom of Industry as well as "free speech, free press and freedom of assemblage."

To equalize the cost of bringing to the attention of the voters, the absolute necessity of Freedom of Industry to preserve our civilization, the advance edition of the booklet "Industrial Liberty" is priced at $1.00 per single copy, and exclusive sales agencies in political wards or counties are offered first on liberal commission basis to owners (or ex-owners) of Independent telephone companies before the offer is extended to owners or ex-owners of other industries. The initial copy and agency reservation may be secured by addressing Henry Shafer, of the Industrial Liberty Committee, 6537 N. Campbell Avenue, Chicago, Ill.

A.T.&T. Operating Net at 4-Year High

Net operating income of American Telephone and Telegraph Co. for May was the highest for the month in four years, totaling $1,793,040. This compares with $1,281,938 in May, 1935.

Gross operating revenue increased $841,917 over May of last year to a total of $8,685,915.

In the first five months net operating income soared to $9,311,219 from $6,325,449 in the corresponding period of 1935. Gross operating income for the period amounted to $43,897,971 as contrasted with $38,573,068 in the first five months of 1935.

The Call Must Go Through

When the telephone line, ninety miles long, between Grafton and Lismore, Australia, broke down during a recent storm, more than 1,359 miles of line had to be used for communication between the two places.

New York's first telephone directory which carried telephone numbers was published in 1880. It contained 2,800 listings.

Ohio Telephone Refund Order Termed "Unsound"

Decision of the Ohio Supreme Court upholding the public utilities commission in ordering the Ohio Bell Telephone Co. to refund $11,832,264 to its customers was assailed recently by A. J. Allen, operating vice-president of the telephone company, as unsound and arrived at by methods frequently condemned by the United States Supreme court. "Until we have had an opportunity for further study of the decision we will be unable to say what action we shall take," he said.

Indiana Associated Places Cable Underground

The Indiana Associated Telephone Corp. is spending in excess of $10,000 for improvements in the city of Goshen, Ind., John W. Troyer, of Elkhart, district manager, has announced. A number of trunk line cables in the northwest part of Goshen are being placed underground, Manager Troyer said. Conduit is being laid to place the wires in. This work is being done to eliminate storm damage.

Union Telephone Co. Seeks $50,000 Loan

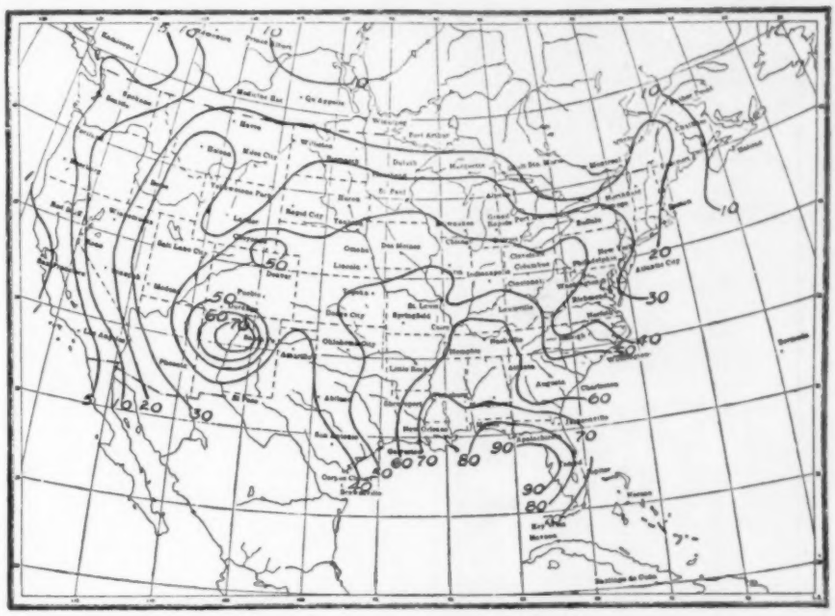
Authority to issue a $50,000 note, payable in 15 years at 5 per cent interest, to Oliver G. Agne of St. Louis, has been sought in a petition filed with the Missouri Public Service Commission by the Missouri Union Telegraph Co., which operates exchanges at Rich Hill and Eldorado Springs.

The money would be used for extensions, refunding and for reimbursements of the treasury of the company for improvements paid out of income during the last five years.

Small Pocket Telephones In Hungary

Newest development in telephone science is a small pocket telephone introduced by Hungary's postal service in the capital city of Budapest. Wall plugs, connecting with the local telephone system, are being installed in hotel lobbies, restaurants, shops, railway stations and various other public places. All a pocket telephone owner has to do is to connect up with one of these plugs and give central the number he wants. The number of calls made is registered automatically on the pocket telephone and payment is made accordingly at specified intervals.

SOMETHING IS being done about the WEATHER



Average number of days per year in which thunderstorms occur.

A telephone man is not much interested in temperature, but he is very much concerned about thunderstorms. Thunderstorms not only induce dangerous potentials but frequently drop power circuits on his lines.

Cook True Gap dischargers shunt to ground lightning discharges without permanently grounding the line. When crossed with power circuits, a fuse will open the telephone circuit and protect the cable or subscriber's premises and instrument.

There is no maintenance problem to Cook True Gap dischargers —only an annual inspection is required.

For your protection, insist on COOK.

COOK ELECTRIC CO.

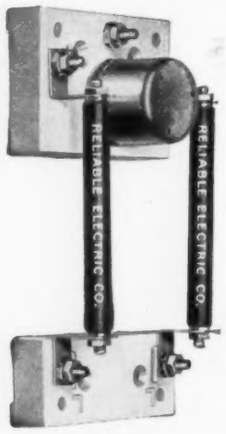
2700 Southport Avenue, Chicago

Reliable

SUBSTATION PROTECTORS

★ ★ ★

Meet every requirement for telephone protection.



NO. 977 HH

An indoor protector that is accurate and self-cleaning in operation, easy to install, and built to last.

WRITE FOR A SAMPLE

Reliable Electric Company
CHICAGO

Independent Takes Toll Case Into State Supreme Court

The Lorain (O.) Telephone Co. has carried its fight with the Ohio Bell Telephone Co. over division of toll charges to the state supreme court, according to press reports.

The Lorain company contends the existing arrangement is unjust, unreasonable and oppressive.

It points out that it receives nothing from the Bell, which controls the long-distance wires outside Lorain county, for handling incoming calls, but that Bell demands approximately 57 percent of all calls coming out of Lorain.

According to H. E. Hageman, general manager of the Lorain company, a cost survey showed that the arrangement was causing a loss of $1,000 a month, a loss that had to be made up from local business.

The Lorain company refused to pay Bell and the contract was thrown before the state utilities commission, which, on April 17, sided with Bell.

An appeal from this decision has been taken to court.

At the same time, however, an aide from the office of Atty. Gen. John Bricker filed a motion on behalf of the commission for dismissal of the appeal on the ground it had not been filed within the 60 days allowed for filing appeals.

In its appeal, the Lorain company charged the commission had excluded testimony on the question of fairness and reasonable ness of the contract.

Southwestern Bell Sells Three Exchanges

Two orders have been issued by the Arkansas Utilities Commission involving the sale of three small telephone exchanges by the Southwestern Bell Telephone Co., and the abandonment of a rural line by the Southwest Arkansas Telephone & Power Co.

The three telephone exchanges were sold to L. R. Hagin and involve properties at Mineral Springs, Ozan and Washington. The sale order was made effective as of February 1. The abandoned telephone line extended from Sheridan to Prattsville.

Bell Received Many Honors

During his lifetime, Alexander Graham Bell, inventor of the telephone, received upwards of thirty medals and decorations, as well as a number of honorary degrees.

CONVENTION SCHEDULE

The Illinois Telephone Association, Pere Marquette Hotel, Peoria, September 17 and 18.

The United States Independent Telephone Association, Hotel Stevens, Chicago, October 13 to 16.

As An Editor Sees The Corporation Tax

"Very few people realize the seriousness of the corporation tax just forced through Congress by President Roosevelt, very much to the dislike of Congress. This tax starts at 8 per cent on the first $2,000.00 profit, 11 per cent on the next $13,000.00 and 13 per cent on the next $25,000.00 and 15 per cent above that. On any profit made by the company and not distributed has to pay an additional tax of 7 per cent. Then the individual who receives a dividend has to pay 4 per cent tax on that. That is a Federal tax. In addition is the 2 per cent state tax. That means a tax of 21 per cent on the dividends of all corporations if the dividends are paid out and 24 per cent if kept in the company.

"Take the Bell Telephone Co. in Anamosa, any improvements that they make such as putting in underground cables in place of overhead wires, building a building to house their office, etc., must pay a 24 per cent tax, as it would be done out of profit. Instead of creating work it will stop further investment."—*Anamosa (Ia.) Eure.*

Southwestern Bell Buys Kansas Companies

Following a recent hearing held at Topeka, at which testimony and exhibits were introduced, the Kansas State Corporation Commission approved the application of the Emporia, Paola, and Sabetha Telephone companies to sell and transfer all of their assets and property to the Southwestern Bell Telephone Co.

The commission granted the Southwestern Bell Co. authority to engage in the telephone business in the following 14 towns: Emporia, Paola, Sabetha, Hamilton, Hartford, Howard, Humboldt, Moline, Neosho Rapids, Plymouth, Reading, Severy, Virgil and Yates Center.

Operation of these properties as a part of the Southwestern Bell Telephone company will begin soon.

WHEN YOU BUY CABLE RINGS
BUY THESE FEATURES

- Easy installation
- Spiral grip
- Curved bearing surface
- Sturdy construction
- Smooth galvanizing
- No tangle packing

SPECIFY CHANCE
"NO-TANGLE" CABLE RINGS

A·B·CHANCE CO.
Utilities Division
CENTRALIA
MISSOURI

SERVICE LIFE UP 14%

NO INCREASE IN PRICE!

"COLUMBIA" GRAY LABEL TELEPHONE BATTERY

NATIONAL CARBON COMPANY, INC.
General Offices: New York, N.Y. *Branches:* San Francisco, Chicago
Unit of Union Carbide UCC *and Carbon Corporation*

on **CHICAGO'S**
COLORFUL
Michigan Avenue

WITH PRIVATE BATH FROM $2.50
WITHOUT PRIVATE BATH FROM $1.50

The charm of a Michigan Avenue address - the luxury of Hotel Auditorium service - the convenience of its "just off the Loop" location - the delights of its world famous dining room - all these are now yours at a very economical cost.

GEO. H MINK
MANAGER

HOTEL AUDITORIUM
MICHIGAN AVE. AT CONGRESS ST

The DILLON TEMPEROMETERS

Register Correct Temperatures of —

- **Paraffin**
- **Compounds**
- **Wiping Solder**
- **Impregnation Wax**
- **Cable Damming Waxes**

THE DELUXE TEMPEROMETER (with dial) registers correct temperatures of paraffin, compounds, wiping solder, impregnation wax and cable damming waxes. Laboratory tests prove that to get the most dependable results these materials MUST be heated to specific temperatures.

THE JUNIOR TEMPEROMETER registers the correct temperature of wiping solder ONLY. Under gas pressure tests, joints ladled with underheated and overheated solder proved to be defective.

Prices, Deluxe Model, $6.00; Junior Model, $4.00.
FOB Chicago.

SOLD BY LEADING TELEPHONE DISTRIBUTORS

DILLON MANUFACTURING CO.
63 EAST LAKE STREET CHICAGO, ILLINOIS

More Hours of Service

. . . that's what every telephone engineer seeks . . . *more hours of service* . . . which means fewer replacements, lower service costs! And that's exactly what Ray-O-Vac telephone batteries offer!

For 3 decades Ray-O-Vac batteries have met and exceeded specifications and requirements on every recognized telephone and light intermittent test, and surpass all government standards. For lower service costs, specify Ray-O-Vac!

RAY-O-VAC COMPANY
Formerly FRENCH BATTERY COMPANY
MAIN OFFICES AND PLANT
MADISON, WISCONSIN
Additional Factories at Clinton, Massachusetts and Lancaster, Ohio

Upholds Telephone Newspaper Advertising

In an editorial discussion of the American Telephone and Telegraph Company's effort to influence public opinion by newspaper publicity and advertising which is being investigated by the Federal Communications Commission, *Advertising Age*, leading advertising magazine, upholds the activities of the telephone company in maintaining contact with the public.

The statement of this publication certainly holds true not only for the Bell System but for the industry at large and telephone companies everywhere should continue to inform the public about the telephone business.

Advertising Age's editorial states:

"One of the subjects which is being investigated in the FCC inquiry into the American Telephone & Telegraph Company is its activities in "influencing public opinion." According to the authority given by Congress in making an appropriation for the purposes of the investigation, this was one of the specific subjects to be tackled, and the implication, apparently, was that efforts in that direction should be regarded as reprehensible.

"A. T. & T. is not only one of the largest companies in America, but also has the reputation of being one of the best managed. This is not to say that it is beyond criticism, since even telephone executives are willing to admit mistakes have been made. But in general the public has been justified in relying on A. T. & T. "not to be stupid," as President Walter Gifford put it in his opening testimony in the current hearing.

"Is a large and important company, with hundreds of thousands of stockholders, and with billions of dollars invested in its properties, debarred from an attempt to influence public opinion? Is a public utility company, especially, ruled out when it comes to providing information and even argument on which the public can base intelligent opinions regarding its policies, methods and services? Should it permit public opinion to be formed only as the result of statements issued from political or bureaucratic sources?

"We believe the questions almost answer themselves. Certainly the public has a right to be informed and a company with as large interests as A. T. & T. owes a duty to its customers, stockholders and employes which cannot be disregarded. It should keep them fully informed regarding its activities, not only through annual financial statements, which are read by comparatively few, but by public statements which will reach as large a percentage of all three groups as possible.

"The advertising of the company has been excellent, in that it has been interesting and informative, and at the same time has built public good will for telephone interests. This undoubtedly is the most effective method by means of which to influence public opinion. We believe that it is entirely legitimate, and that A. T. & T. would have been remiss in its duty if it had not maintained contact with the public, including customers, employes and the stockholders through its advertising, as it has done over a long period.

"The chief protection which any company has against unfairness and discrimination on the part of political agencies is an active and favorable public regard. Advertising which tells the truth regarding legitimate company objectives in an interesting way is thus a bulwark against the attacks of demagogs, who have become so numerous, and so influential in our national life."

$6,000,000 Cut in Toll Rates Made by A.T.&T.

A reduced schedule of rates for long distance telephone conversation, which, it is asserted, will save users about 6,000,000 annually, has been filed with the Federal Communications by the American Telephone and Telegraph Co.

The rate cut, which affects all interstate telephone calls, will become effective Sept. 1, and is the seventh reduction in ten years. The new rates are applicable to long distance calls of more than 240 miles.

The announcement said that similar reductions are being made by many associated companies of the Bell system, which will bring the total yearly savings of long distance telephone users to more than $7,350,000.

The reduction, the company said, was made possible by the present upward trend in long distance usage and by "operating results from the company's policy of continuous development and research."

Under the new schedule persons in Chicago, for example, may make a three-minute day call to New York for $2.50, compared with the old charge of $3. The night rate will be cut from $1.65 to $1.45. A New York-San Francisco day call will cost $7.50, compared with $9.

In addition, overtime on all person-to-person calls after six minutes of conversation will be the same as the station-to-station overtime charges for the same distances.

The MASTER Ringing Machine

Automatically Compensates for Variations in Input Frequency and Voltage

Nothing to Wear Out!

- No Moving Parts
- No Adjustments
- Economical
- No Radio Interference
- Produces a Powerful Ringing Current
- Operates on 110 volts A.C.

Price $45.00

30 DAYS FREE TRIAL

You Take No Risk

SUB-CYCLE

LORAIN PRODUCTS CORPORATION,
Lorain, Ohio.

Lorain Products Corporation is exclusive manufacturer for use and sale in United States. Address foreign inquiries to Automatic Electric Sales Co., Ltd., Chicago, Ill.

Sold By Leading Distributors

"COLUMBIA" GRAY LABEL TELEPHONE BATTERY SERVICE LIFE UP 14%

NO INCREASE IN PRICE!

NATIONAL CARBON COMPANY, INC.

General Offices: New York, N.Y. *Branches:* San Francisco, Chicago

Unit of Union Carbide UCC *and Carbon Corporation*

Exide BATTERIES for every Telephone Service

THE ELECTRIC STORAGE BATTERY CO., *Philadelphia*

World's largest manufacturers of storage batteries for every purpose.

COFFING HOISTS

Advanced Design

For Pulling GUY WIRES MESSENGERS UNDERGROUND CABLES, etc.

COFFING HOIST CO., Danville, Ill.

Telephone Engineer NOW

3 Years for $2
1 Year for $1

Order Your Subscription Direct

Phillips Cords are definitely better

In the new PHILLIPS telephone cord, the outer covering is composed of a material never before used for the purpose. This wiry fabric produces a tougher, longer-wearing braid than anything heretofore experienced—one that adds literally months and years of wear to the useful life of the cord!

Besides this, still further improvement has been effected by laying the conductors flat instead of twisting them together in the usual way—a construction which virtually eliminates kinking. Insulation resistance also has been materially increased by means of a specially-developed process of impregnation.

Here at last in the PHILLIPS cord, is a better cord for every telephone use—one that you are urged to try at your earliest convenience. To order, merely specify number of conductors, length of trim desired. Prices gladly quoted upon request.

●

PHILLIPS PRODUCTS INCLUDE: Bare and Insulated Copper Wires—Rubber Insulated Wires—Enameled Wires—Magnet Wire—Power Cables—Switchboard Cables—Paper Insulated Cables—Flexible Cords—Electrolytic Copper Rods, Shapes, etc.

PHILLIPS ELECTRICAL WORKS LIMITED

ESTABLISHED 1889

BROCKVILLE, ONTARIO, CANADA

FACTORIES — MONTREAL AND BROCKVILLE

Cable Address: Philelec, Brockville

Distributors for Canada: Canadian Telephones & Supplies Limited, Toronto, Montreal, Winnipeg, Regina and Vancouver

STURGIS

TRUE POSTURE

Operator Chairs

Easy
Quick
Adjustments

No. 426

A true posture chair designed to increase efficiency, mental alertness, reduce fatigue, improve the health and comfort of the operator.

Write For Particulars
Available in 3 Different Heights.
Distributed by
STROMBERG-CARLSON TELEPHONE MFG. CO.
100 Carlson Road, Rochester, New York
Manufactured by
STURGIS POSTURE CHAIR CO.
Sturgis, Mich.

Crapo
GALVANIZED PRODUCTS

Telephone Wire
▼▼
Steel Strand

Crapo Galvanizing neither cracks nor peels —not even when subjected to splicing, twisting or sharp bending. Its tight, ductile, *pure zinc* coating insures corrosion resisting joints, longer life, lower maintenance costs.

Crapo Galvanized Wire is made in EBB, BB and Steel grades. *Crapo* Galvanized Seven Wire Steel Strand furnished in Standard, Siemens-Martin, High Strength, Extra High Strength.

Indiana Steel & Wire Co.
Muncie, Indiana

Explains Walsh-Healey and Capital Stock Tax Bills

During the latter part of July the United States Independent Telephone Association sent out two letters to member companies which came too late to include in the July issue of TELEPHONE ENGINEER. The letters discussing the Walsh-Healy Bill and the Capital Stock Tax Returns follow:

Walsh-Healey Bill

"Inquiry has been made by several of our members as to whether the Act passed by Congress just before its adjournment, requiring all persons entering into contracts with the Government to comply with certain wage and hour requirements, such as the 8-hour day and 40-hour week, applies to telephone companies. This Act is known as the 'Walsh-Healey Bill'.

"The Act does not apply to telephone companies. In Section 9 of the Act appears this phrase: 'Nothing in this Act shall be construed to apply . . . . to common carriers subject to the Communications Act of 1934.' Should you be asked by any Government officer in connection with telephone service to sign a contract requiring your compliance with the wage and hour provisions of the Walsh-Healey Bill, please advise us. We will send you a full copy of the Act and such later advice as we may have received from Washington."

Capital Stock Tax

"In the preparation of the Capital Stock Tax Returns due this month, it is important to note that the Revenue Act of 1936, signed by the President on June 22, 1936, reduces the rate from $1.40 per $1000 to $1.00 per $1000. Forms for the collection of the tax were distributed by the Treasury Department before the passage of the Act, containing the erroneous rate of $1.40 per $1000. Telegraphic instructions have been sent to all Collectors of Internal Revenue directing them by means of a rubber stamp to correct the forms in accordance with the new law. If the forms which you have received have not been so corrected, it is important to bear in mind that the correct rate for the computation of this tax is $1.00 per $1000 and not $1.40 per $1000. Under date of June 26, 1936, the Treasury Department made the following public announcement on this subject:

" 'The Bureau of Internal Revenue calls attention to the fact that Section 401 of the Revenue Act of 1936 reduces the rate of capital stock tax imposed on corporations by Section 105 of the Revenue Act of 1935 from $1.40 to $1.00 for each full $1,000 of the declared value. In filing returns for the current taxable year ending June 30, 1936 (which returns are required to be filed on or before July 31, 1936, with the collector of internal revenue for the district in which the principal place of business of the corporation is located), corporations are required to make an original declaration of value for their capital stock and pay any tax due at the rate of $1.00 for each full $1,000 of such declared value. Under the law an entirely new value may be declared for the capital stock on the 1936 return, regardless of any declaration of value made for any previous year.'

"If you have filed a return on the old basis, we suggest that you write to your collector and ask that it be returned for correction under the new law, and at the same time ask for an extension of time in which to make the corrections and file the report."

Line and Desk: Questions and Answers

(Continued from page 18)

may hang their wraps which also is provided with a headset compartment in the top.

Q. Is paint really considered harmful on a wood telephone pole?

A. Time has proved that paint is detrimental when used on an untreated wood pole. Paint acts as a seal and retards moisture evaporation, also provides an ideal condition for fungus growth and decay. Moisture enters holes made by linemen's spurs and surface checks and is not readily evaporated through the painted surface. Fungi spores enter the same holes, attack the wood and render it soft and punky in a very short time. This will not happen on an unpainted pole where the natural surface affords rapid drying of the wood and although the surface will "weather" there will not be decay. When a pole weathers it blends well with nature's colors and its appearance is not often considered objectionable. When color is necessary, a good creosote oil stain is strongly recommended in lieu of paint. Stain has some preservative value, does not fill the cells of the wood, so that moisture can evaporate naturally and rapidly.

The world's first radio telephone service, between Los Angeles and Santa Catalina Island, Cal., was opened to the public on July 16, 1920.

CORDS

Bronze Tinsel Receiver Cords 15c
Bronze Tinsel Desk Stand Cords 30c
Special Sale on Switchboard Cords
Special Sale on Drop Wire.

INDEPENDENT CORD CO.
FRAMINGHAM, MASS.

14% INCREASE IN SERVICE LIFE!

NO INCREASE IN PRICE!

"COLUMBIA" GRAY LABEL TELEPHONE BATTERY

NATIONAL CARBON COMPANY, INC.
General Offices: New York, N. Y. *Branches:* San Francisco, Chicago
Unit of Union Carbide UCC *and Carbon Corporation*

TELERING

ECONOMY ◆ RELIABILITY

Order One NOW for a 30-day Free Trial

ONLY ONE CONTACT!

PRICE $44.00 EACH
F.O.B. Elyria

Reliable ringing service is essential in providing satisfactory telephone service.

Use TELERING and provide the MOST reliable service at the LEAST cost.

Current Consumption negligible

Positively No Radio Interference

Directly converts Commercial Alternating Current to Telephone Ringing Current.

You can always depend upon our full co-operation and prompt service.

Sold by Leading Telephone Distributors

TELKOR, Inc., Elyria, Ohio

Cable

...and 60,000 other items

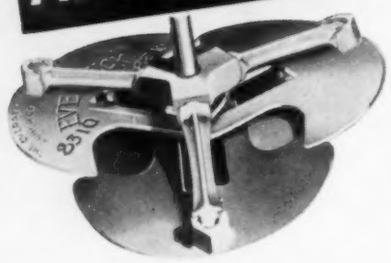
WHERE dependability counts—only the highest quality electrical products will do. One such quality product is Western Electric Lead Covered Cable—a cable whose dependability is insured by the most exacting of manufacturing standards.

But that's not all. Out of its roster of 60,000 electrical items, Graybar is prepared to meet *any* need of a telephone industry. And behind *every* Graybar item stands the Graybar reputation for quality that goes back 67 years.

Graybar

OFFICES IN 79 PRINCIPAL CITIES
EXECUTIVE OFFICES: GRAYBAR BUILDING, NEW YORK, N. Y.

For SAFE ANCHORAGE



EVERSTICK ANCHORS...

★ Unusual conditions test the raliability of Anchors. Sleet, blizzards, wind and floods create extra strains. Eversticks with their excess holding power are built to meet the toughest weather conditions. Certified Malleable Iron insures long life, strength and rust resistance.

Sizes and styles for heaviest construction to light rural electrification lines. Write for Bulletin No. 1134.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

W. L. Runzel, President, brings to this organization 47 years' experience in the manufacture of this type of telephone equipment.

Telephone and Switchboard Cords and Wire

May we quote you on your requirements?

RUNZEL CORD and WIRE CO.
4727-31 Montrose Ave., Chicago
The Home of the Perfect Cord

Coming to ——
PHILADELPHIA?

Room with Bath for **$2.50**

HOTEL PHILADELPHIAN
(Formerly Hotel Pennsylvania)
39TH *and* CHESTNUT STS.

4 New Commercial Batteries Announced by Exide

Four new commercial types of Exide batteries for trucks are announced by The Electric Storage Battery Co. These new Exides have been put on the market to meet the demand for batteries especially dsigned for service on light, high-speed trucks where the conditions are different from those under which passenger cars are operated. The designs of the batteries are based to a great extent on the results of months of study in the field by Exide engineers.

Each battery is equipped with Mipor, the permanent latex base separator used exclusively in Exide batteries; and the Exide slotted-rubber plate protector—a combination that, according to the manufacturer, will give extraordinary long life and high starting capacity.

Mipor resists heat, an important feature for batteries used in trucking service where long daytime runs and overcharging are the rule rather than the exception. Likewise the slotted-rubber plate protectors help to hold the active material in the grids and lengthen the life of the plates. This also is an important feature because of the tendency of excessive charging, so common in trucking service, to loosen the active material.

Exide field engineers, it is said, have been devoting a large part of their time to determine the best design of battery for this job. They have studied a range of trucking operations from short-haul, frequent-stop service (where routes are 20 miles long with up to 300 delivery stops) to long-distance hauling between cities where, with relief drivers, trucks or tractor-trailer units cover 500 to 600 miles per day with no stops except for traffic.

The lighter high-speed vehicle uses a high-compression engine which requires maximum battery starting capacity. Regulations, as well as the requirements for safety, have increased the lighting load with extra tail lights and marker lights. Other electrical accessories for driver comfort, like cab heaters, have been added. These loads require minimum capacity batteries for lighting and at the same time require higher generator charge raets. Higher charging rates lead to overheating of the battery, especially on long daylight runs in hot weather.

It became evident from the facts collected by Exide field engineers that batteries entirely satisfactory for passenger-

(Please turn to page 39)

The Good Habit for Telephone Men

It's always a good habit for telephone men to consult the Suttle Salesman when in need of supplies or equipment.

No matter how large or how small the properties you are responsible for, you'll always find some values or services in this book which will save you money and solve your problems better.

Be Sure to Refer to the Suttle Salesman Catalog.

Suttle Equipment Co.
LAWRENCEVILLE, ILLINOIS

A NEW COVERAGE!

● Because of its exclusive engineering articles, key communications executives and engineers of leading Railroads and Oil Pipe Lines read TELEPHONE ENGINEER (only monthly national journal serving telephone industry). These companies purchase and maintain their own telephone systems and form a concentrated market with tremendous buying power.

● Advertising in TELEPHONE ENGINEER gives economic coverage of these important markets in addition to the coverage of the telephone industry.

TELEPHONE ENGINEER
MANAGEMENT ● ENGINEERING MAINTENANCE
185 N. Wabash Ave. — Chicago, Ill.

car service do not give satisfactory performance in commercial service, it is pointed out.

Other features of the new Exide commercial types are extra-high thick plates 5/8" higher than standard, and positive plates of the same thickness as negatives. Extra electrolyte space is provided, which lessens the frequnecy with which the battery must be watered; and a quarter-turn vent plug contributes a time-saving factor when such watering is necessary.

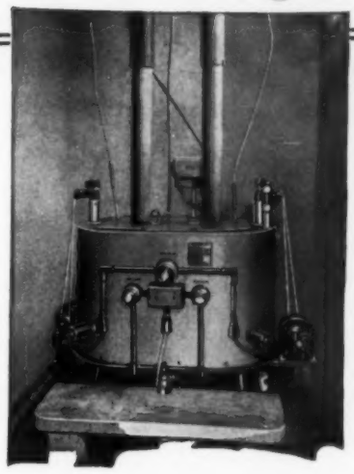
The plates are bevel-cornered with feet; the intercell connectors are extra heavy; and the post seals, corrosion-proof. The batteries are assembled in heavy duty, genuine hard-rubber containers equipped with handles.

The Exide commercial type batteries equal or exceed the S.A.E. and U. S. Government standards for capacity and life, according to the company.

$60,000 Improvements

Expenditure of $60,000 for modernization of equipment and enlargement of quarters has been authorized by directors of the Kenton (O.) Telephone Co. building to be followed by changes in the present three-wire telephone system to a two-wire system by the latter part of 1936. J. D. Park is manager of the company.

Bomb Aged and Tested



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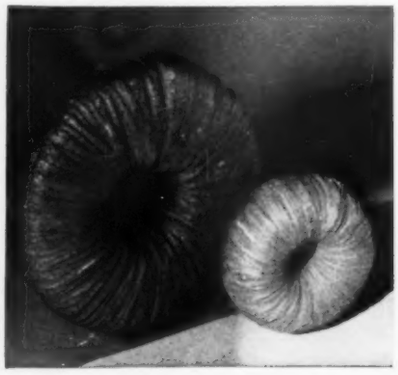
Automatic Offers New, Small Size, Loading Coil

Announcement has been made by Automatic Electric Co. of the development of its new Monotype loading coil of very small size. The new coil has the same electrical and magnetic characteristics as coils formerly available, but due to the discovery of a new type of magnetic core material, coil sizes, for given inductance values, are much reduced, thus effecting a corresponding reduction in sizes of the containers in which the coils are placed, it is said.



This view of the new Automatic Electric "Monotype" loading coil side by side with the former coil shows the marked reduction in size effected by the use of Corlite. The two coils have the same electrical and magnetic characteristics.

The new magnetic core material, known as Corlite, was discovered by engineers of Associated Electric Laboratories, Inc., in their search for a material having a high permeability, low hysteresis loss and freedom from polarization, these characteristics being especially important in the selection of a core material for loading coils. As an indication of the effect of these qualities in reducing loading coil size, reference is made to the accompanying illustration which shows samples of the old and new coils side by side. Actual dimensions of the new coil (120 mh.) are 2¾ inches in overall diameter, and 1¼ inches in thickness.

Following former manufacturing practice, Monotype loading coils are machine wound and carefully balanced both as to resistance and inductance so as to insure the high degree of uniformity so essential to satisfactory perform-

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Stromberg Carlson desk set complete with 4-bar 1000 or 1600 ohm ringer inside connection signal set @	9.00
Automatic Elec. desk set complete with 4-bar 1000 or 1600 ohm ringer inside connection signal set @	9.50
Kellogg New Grabaphone hand set complete with W. E. No. 240 3-bar 1000 or 1600 ohm ringer signal set @	11.00
Kellogg No. 729 S. A. Straight line C. B. Oak finish wood hotel set with Booster coil @	6.75
Kellogg No. 631 C. B. Steel hotel set with straight line ringer & Booster coil @	6.85
Western Elec. No. 21 W. 1 M. F. Cond. 40c ea. No. 21d or E 2-M F. Cond. @	.35
Western Elec. No. 20 C. B. Ind. Coils @	.35
Kellogg No. 53 2 M. F. Condensers @	.35
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ance, the company states.

For maximum electrical and mechanical protection, several new types of loading coil containers have been designed. These are made of steel, and are arranged for housing a maximum of 5, 10, 15, 25, 50, 75, 100 and 200 coils per container. The containers are of circular, triangular or rectangular cross section, depending on the number of coils to be placed in each container.

The inductance values of Monotype loading coils follow the well established requirements of the leading operating companies; namely, 44, 88, 120 and 136 mh., although the design of the coil readily lends itself to other inductance values when conditions require.

Telephone Companies Want Hearing on REA Project

The Lancaster (Neb.) Rural Public Power district has filed its application with the state railway commission seeking authority to build 354 miles of transmission lines to electrify the western half of the county.

The district was given a $396,000 federal allotment May 11 for the first phases of the development, to serve farm customers. The estimated cost of the entire project, embracing all of Lancaster county except the city of Lincoln is $885,000.

A request for a hearing accompanied the application. Several of the telephone and railroad companies whose communication lines will be crossed by the transmission wires and affected by inductive interference have not waived a hearing. Most of the companies so affected, however, have filed waivers

Catalog Describes Brushes For Equipment Cleaning

A catalog describing its brushes for cleaning electrical equipment, paint brushes, artist and sign writers brushes, and industrial brushes of every type, is now available for mailing by David Linzer & Sons, Inc., 10 Astor Place, New York City.

Catalogs will be forwarded to those interested requesting them by mail. Many new improved constructed brushes are shown in this catalog, including all grades of "Pre-Treated" paint brushes, which are already broken-in for immediate use.

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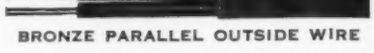

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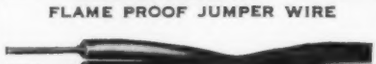

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